Chapter 1
DISTRICT OVERVIEW

DISTRICT HISTORY

Soon after Florida became a state in 1845, the federal government granted the state over 20 million acres of wetlands and swamps. During this early development period, the federal and state governments encouraged the drainage of wetlands for agriculture and residential uses.

The Everglades Drainage District (EDD), forerunner of the District, was created in 1907 to facilitate drainage of the Everglades. By 1927, six major drainage canals and numerous minor canals had been constructed, along with 47 miles of levees and 16 locks and dams. The EDD construction program ended in 1928 following the hurricane of that year. In 1931, the EDD defaulted on its bond payments, suffering the effects of the Great Depression and the collapse of the Florida land boom of the 1920s.

Although the hurricane of 1928 ended the construction activities of the EDD, it spurred creation of the Okeechobee Flood Control District in 1929, which improved flood control by constructing levees, control gates, and floodway channels along the shores of Lake Okeechobee. The southern shore of Lake Okeechobee was diked and the St. Lucie and Caloosahatchee rivers were used to divert water that had formerly flowed south to the Atlantic Ocean and the Gulf of Mexico.

In 1947, torrential rains flooded Central and South Florida. Two hurricanes struck the Everglades and Lake Okeechobee after earlier rains had already saturated the soils, resulting in extensive flood damage. The extent of area flooded is shown in **Figure 2**, and included the majority of the region presently within the District. In its report following the flooding, the U.S. Army Corps of Engineers (USACE) reported that “as these areas will inevitably grow and expand even without adequate flood protection, larger damages may be expected unless preventive measures are taken” (Huser, 1989).

Less than a year after the floods of 1947, the USACE recommended, and Congress authorized, $208 million for a flood control system, the Central and Southern Florida Project for Flood Control and Other Purposes (C&SF Project)[1]. The C&SF Project was planned as a complete system of canals, storage areas, and water control structures spanning the area from Lake Okeechobee to both the east and west coasts, and from Orlando south to the Everglades. In addition, the C&SF Project was intended to improve recreational and navigational opportunities. The C&SF Project was designed and constructed by the USACE. The Florida Legislature created the Central and Southern Florida Flood Control District (FCD) in 1949 to serve as local sponsor for the C&SF

1. During the 1960s the title was shortened to Central and Southern Florida Project. The C&SF Project acronym is used for both versions of the name.

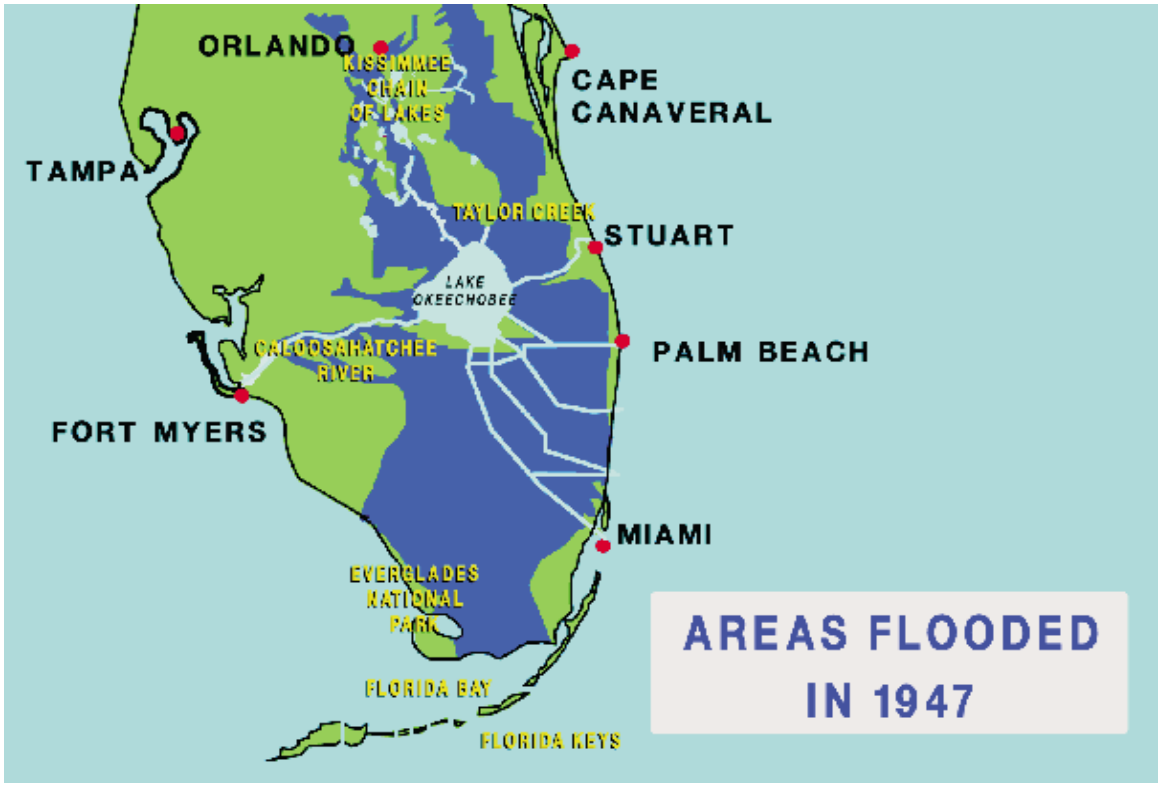


Figure 2. Map of Area Flooded in 1947.

Project. The FCD included the areas previously within the boundaries of the EDD and the Okeechobee Flood Control District. In the 1950s the FCD's efforts included acquisition of lands, easements, and rights-of-way for the construction program and for water storage. By 1954, the FCD had acquired titles or easements for 1,354 square miles of Everglades wetlands in Palm Beach, Broward, and Miami-Dade counties which became the Water Conservation Areas (WCAs). The three WCAs represent almost half of the original freshwater Everglades in Florida. By 1959, construction was completed on a network of levees and canals that circled and crossed the fertile mucklands of the Everglades Agricultural Area (EAA). Some additional east coast canals were also constructed at this time, including C-17 and C-18 in Palm Beach County (Huser, 1989).

The decade of the 1960s was a time of major construction for the C&SF Project. By the early 1960s, the WCAs were completed, and about 700,000 acres of land in the EAA had been drained and leveed. The dike around Lake Okeechobee was enlarged and extended. Pump stations were constructed. Dredges and draglines enlarged the Caloosahatchee River, excavated the Kissimmee River, and cut channels in the Kissimmee Chain of Lakes. Spillways, dams, and navigation locks were built on the canals. The USACE published the first in a series of maps, color coded in red and green, entitled Central and Southern Florida Flood Control Project. Red lines showed works that were completed or under construction. Green lines showed works that were planned but not completed. Periodically, the USACE updated this map and reprinted it, and over the years more and more green lines became red lines (Huser, 1989). However, not all the planned

canals and structures annotated by green lines were ever built, due to environmental concerns, costs, and further evaluation of these planned facilities.

The FCD initially operated the C&SF Project primarily for water control and flood protection. In the late 1960s and early 1970s, environmental awareness increased and the need for protection for water and related natural resources became more emphasized. Passage of the Florida Water Resources Act of 1972 by Florida's Legislature broadened the FCD's mission, and added responsibilities for water supply, water quality, and natural systems management to the existing flood protection mission. This act created five water management districts in the state, and expanded their responsibilities to include control and regulation of ground and surface waters and their use. **Figure 3** shows the boundaries of Florida's five water management districts. Chapter 373, F.S., also established a new system of water rights in Florida. One attains the right to use water through application to the appropriate water management district, and each water management district administers a consumptive use permitting program, pursuant to Section 373.223, F.S.

In 1976, the Florida Legislature changed the name of the FCD to the South Florida Water Management District for consistency with the other water management districts and to more accurately reflect the agency's broadened mission. The District covers 17,930 square miles, or about 31 percent of the State of Florida. The District includes all or part of 16 counties, and extends from southern Orlando to Key West and from Fort Myers to Fort Pierce.

The headquarters for the District are located in West Palm Beach. Service centers are located in Orlando, Okeechobee, Stuart, West Palm Beach, Fort Lauderdale, Miami, Islamorada, Naples, and Fort Myers (**Figure 4**). Service centers were established to offer District services and expertise at the local level and to provide more direct and responsive access to permitting and other District functions.

District field stations are located in Kissimmee, Okeechobee, West Palm Beach, Fort Lauderdale, Miami, Homestead, Naples, and Clewiston. District area offices are located in the Dupuis Reserve, Fort Pierce, Naples, and West Palm Beach. Field stations and area offices help the District to better operate and manage the vast regional water management network which includes 1,800 miles of canals and levees, close to 200 large water control structures, and over 2,000 smaller structures.

In addition to the Governing Board for the District, the Florida Legislature established a Basin Board for the Big Cypress Basin, which was officially created on January 1, 1977. As required by 1976 legislation, a District Governing Board member was named ex officio chairman of the new Big Cypress Basin Board. Soon after its organization in 1977, the Big Cypress Basin Board determined that the proper maintenance of certain key water control structures in the major drainage system would address the broad objectives of conservation, preservation, and enhancement of the water resources of the region. Accordingly, successive agreements between Collier County and the District have transferred operation and maintenance responsibilities of numerous water control structures to the Big Cypress Basin Board. As of 1999, the Big Cypress Basin Board had responsibility for operation and maintenance of, as well as providing

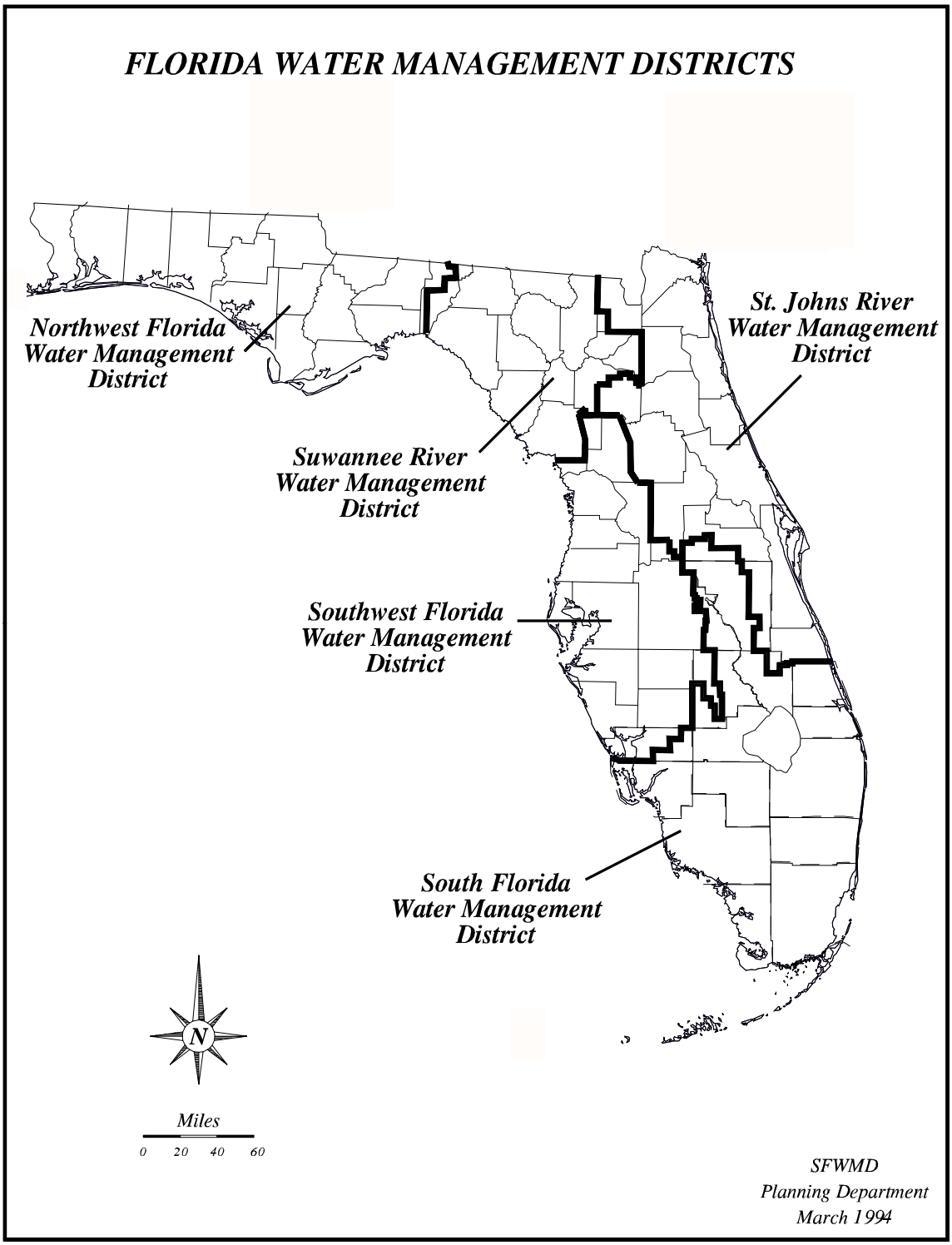


Figure 3. Boundaries of Florida's Five Water Management Districts.

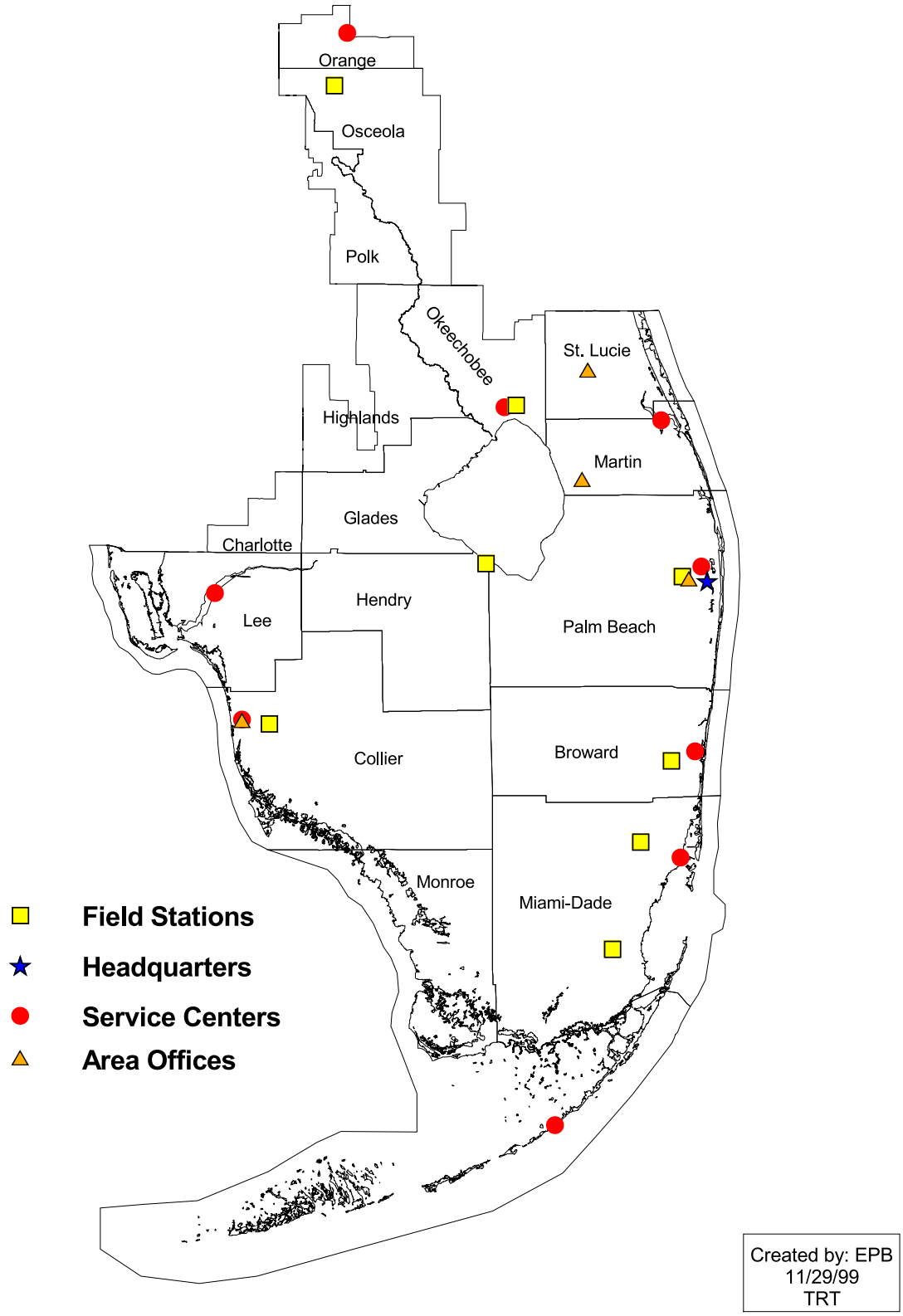


Figure 4. Location of SFWMD Facilities.

planning and capital improvements for, 163 miles of primary canals and 39 water control structures within the Big Cypress Basin.

PLANNING REGIONS

The District is divided into four regions within which planning and other activities are focused: the Lower East Coast (LEC), Lower West Coast (LWC), Upper East Coast (UEC), and Kissimmee Basin. **Figure 5** shows the four planning regions. Regional populations and irrigated agricultural acreages were analyzed as part of the *Districtwide Water Supply Assessment* (DWSA) (SFWMD, 1998b) and are presented below.

Lower East Coast Planning Region

The LEC planning region includes Palm Beach, Broward, and Miami-Dade counties and portions of Monroe, Hendry, and Collier counties. The LEC planning region encompasses a sprawling, fast-growing urban complex along the coast; extensive agricultural lands, including the EAA; critical environmental resources, such as the Everglades ecosystem; and important estuaries, including Biscayne Bay and Florida Bay. The region had a population of 4,518,401 in 1995 and is projected to increase to 6,086,700 by 2020. During the same period, irrigated agriculture is projected to decline from 569,000 acres to 504,000 acres (SFWMD, 1998b). The existing population is concentrated in the coastal areas of Miami-Dade, Broward, and Palm Beach counties, which are expected to remain the population centers for the region.

Lower West Coast Planning Region

This region includes all of Lee County and parts of Charlotte, Collier, Glades, Hendry, and Monroe counties. Rapid growth in population and irrigated agricultural acreage within the LWC planning region have caused demands for water to increase significantly. This region had 590,939 residents in 1995 and the region’s population is projected to increase to 992,805 by 2020. In 1995, the region had 244,000 acres of irrigated agriculture, and this is projected to increase to 293,000 acres by 2020 (SFWMD, 1998b). The existing population is concentrated in the coastal areas of Lee and Collier counties. These areas are expected to remain the population centers for the region.

Upper East Coast Planning Region

The UEC planning region is comprised of St. Lucie and Martin counties and eastern Okeechobee County. The UEC planning region had a total population of 283,457 in 1995 and is projected to grow to 456,580 residents by 2020. From 1995 to 2020, irrigated agriculture is projected to increase from 186,000 acres to 211,000 acres (SFWMD, 1998b). The existing population is concentrated in the coastal areas of Martin and St. Lucie counties. These areas are expected to remain the population centers for the region.

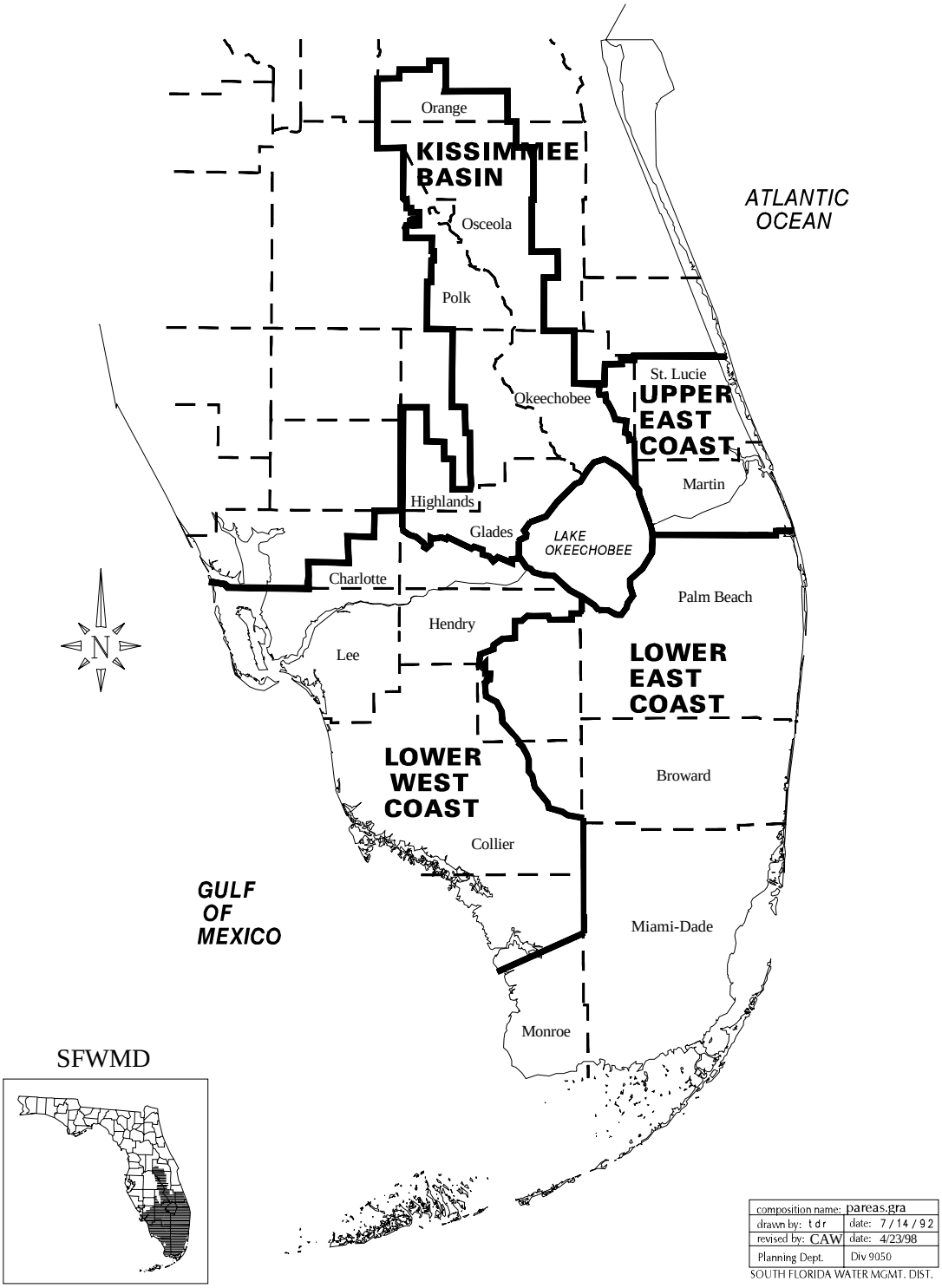


Figure 5. Planning Regions within the SFWMD

Kissimmee Basin Planning Region

The Kissimmee Basin planning region includes parts of Orange, Osceola, Polk, Highlands, Okeechobee, and Glades counties. The majority of the basin drains to the Kissimmee River, though some areas drain into Fisheating Creek, the canal system within the Indian Prairie Basin, or a few landlocked lakes within the basin. A few fringe areas drain to the Southwest Florida or St. Johns River water management districts. The population of this region is projected to increase from 362,837 in 1995 to 686,696 by 2020. In 1995, the region had 77,000 acres of irrigated agriculture, and this is projected to increase to 117,000 acres by 2020 (SFWMD, 1998b). Urban growth is anticipated to be concentrated in Orange and northern Osceola counties, while irrigated agricultural acreage is anticipated to increase to the south, in Highlands, Okeechobee, and Glades counties. Most of the region is rural/agricultural and this pattern is projected to continue through 2020.

PROGRAM OVERVIEW

To promote consistency among water management district budgeting and to aid the Florida Department of Environmental Protection (FDEP) in their review of water management district budgetary information, each water management district has agreed to categorize expenditures into six program areas. The District Fiscal Year 2000 (FY2000) budget totals $469 million. **Table 1** and **Figure 6** show the percentages of the total budgeted expenditures and personnel planned to be spent for each of the program areas in FY2000. The following sections briefly describe each of the program areas. A more detailed description and analyses of these program areas may be found in the *Standard Format Tentative Budget Submission* (SFWMD, 1999).

Table 1. Budgeted Expenditures and Personnel by Program for FY2000.

Program No.	Program Title	FY2000 Budgeted Expenditures	Percent of Total Expenditures	FY2000 Budgeted Personnel	Percent of Total Personnel
1	**Water Resources Planning and Monitoring**	$76,199,621	16.2%	478	25.3%
2	**Acquisition, Restoration, and Public Works**	$242,669,329	51.7%	199	10.5%
3	**Operation and Maintenance of Lands and Works**	$88,784,837	18.9%	666	35.3%
4	**Regulation**	$13,264,414	2.8%	203	10.7%
5	**Outreach**	$5,436,814	1.2%	35	1.9%
6	**Management and Administration**	$42,766,642	9.1%	308	16.3%
	Total	$469,121,657		1,889	

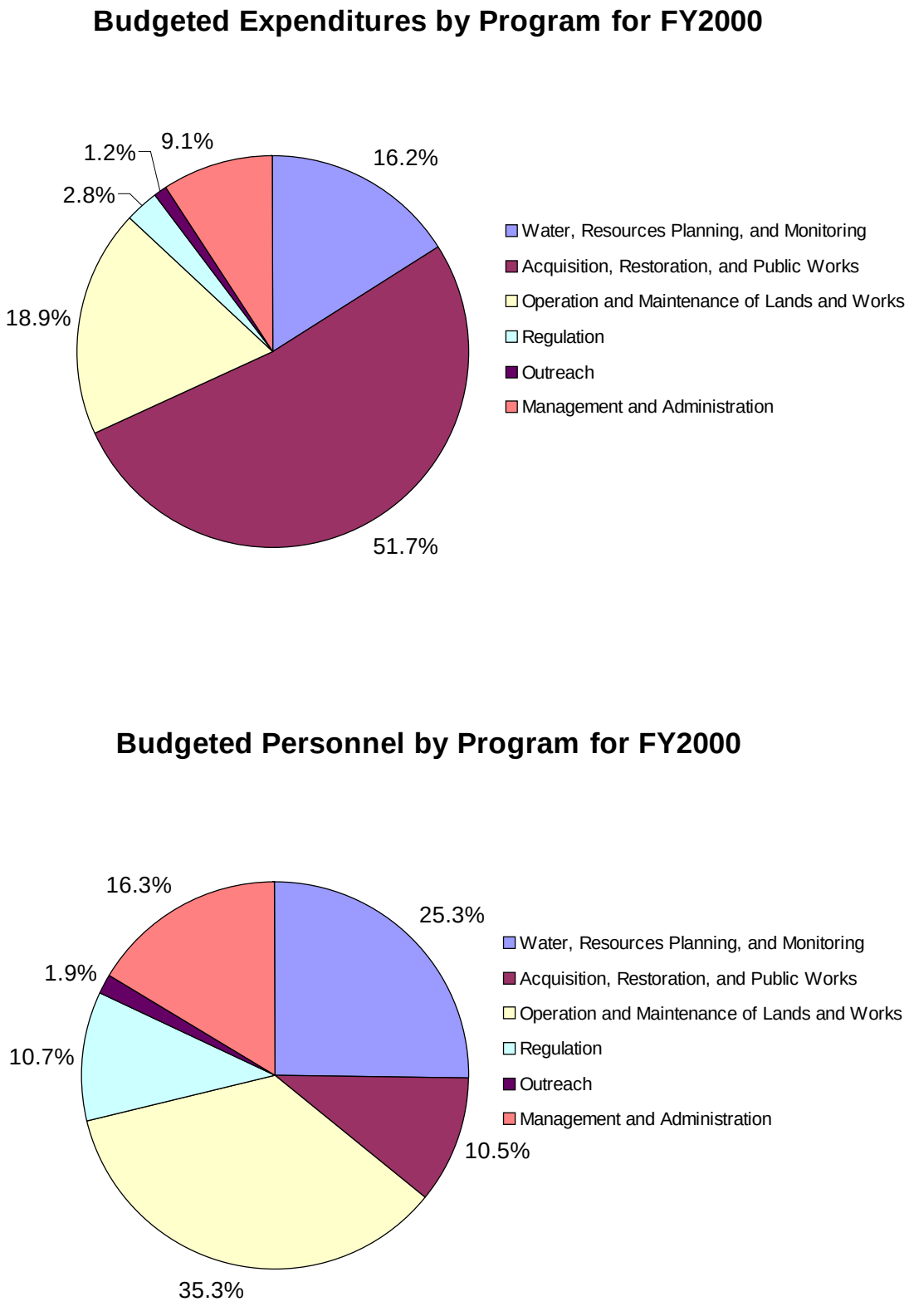


Figure 6. Budgeted Expenditures and Personnel for FY2000 by Program.

Program 1. Water Resources Planning and Monitoring

Definition

This program includes all water management planning, including water supply planning, development of Minimum Flows and Levels (MFLs), and other water resource planning; research, data collection, analysis, and monitoring; and technical assistance, including local and regional plan and program review.

General Description

The Water Resources Planning and Monitoring Program addresses the interactions of water supply, flood protection, water quality, and natural systems management. This program provides comprehensive long-range guidance to address demands for water and the ability of water resources to handle these demands.

Program 2. Acquisition, Restoration, and Public Works

Definition

This program includes the development and construction of all capital projects (except for those contained in Program 3, Operation and Maintenance of Lands and Works), including water resource development projects/water supply development assistance, water control projects, and support and administrative facilities construction; cooperative projects; land acquisition, including Save Our Rivers (SOR)/Preservation 2000); and the restoration of lands and water bodies.

General Description

The District is engaged in a variety of capital projects. These include land acquisitions identified in the District's Five-Year SOR Plan, the East Coast Buffer initiative, and land purchases associated with the Kissimmee River and Florida Bay restoration efforts. Other capital projects include various water resource development projects involving the design, permitting, and construction of projects which will serve to support the allocation and development of water supply. The District is also involved in constructing support and administrative facilities such as the Emergency Operations Center and Field Operations Center, as well as the construction of navigation locks, pump station modifications, and canal improvements necessary to operate and maintain the District's aging regional flood control system. In addition, the District provides financial and technical assistance to local governments in building and implementing storm water and alternative water supply projects. Finally, the District's largest capital project is the Everglades Construction Project (ECP), which includes the design and construction of various Stormwater Treatment Areas (STAs), pump stations, and other capital facilities necessary to restore the Everglades, consistent with the Everglades Forever Act.

Program 3. Operation and Maintenance of Lands and Works

Definition

This program includes all operation and maintenance of District operation and maintenance facilities, flood control and water supply structures, lands, and other works authorized by Chapter 373, F.S.

General Description

The operation and maintenance of lands and works is required to achieve effective operation of pumping facilities and water control structures for flood protection, water supply, and environmental flows/levels. Key products include the maintenance of pumping facilities, water control structures, canals and levees, and associated equipment. Emergency work and operations of the C&SF Project must be performed on demand, and is often driven by meteorological factors and other conditions outside the District's control. Maintenance of the C&SF Project must be performed on a preventative maintenance schedule basis. Management decisions and policy directions regarding the operation and maintenance of the C&SF Project are key elements of this program. Flood control and water supply operational decisions are executed by continuous 24-hour monitoring and control of the District's water management system. The ability to monitor the water management system on a real-time basis, using telemetry, significantly reduces the potential to incur serious damage to property and loss of life by minimizing the threat to public safety from heavy rainfall events. It also provides the capability to improve water supply, protect the coastal freshwater aquifers from the intrusion of salt water, and allow for water deliveries to meet environmental needs.

Program 4. Regulation

Definition

This program includes water use permitting, water well construction permitting, water well contractor licensing, environmental resource permitting, permit administration, compliance and enforcement, and sovereign submerged lands authorizations as delegated by the Board of Trustees of the Internal Improvement Fund. The Board of Trustees consists of the Governor and Cabinet. Most state land is titled in the name of the Board of Trustees, so when the state carries out real estate transactions they come before this version of the Governor and Cabinet. The FDEP Division of State Lands is the state agency that reports to the Board of Trustees.

General Description

The mission of the Regulation Program is to manage and protect the South Florida's water resources through 1) review and evaluation of applications and issuance of permits, 2) inspections to determine compliance with permit conditions, and 3) enforcement actions. The components include environmental resource permits, sovereign

submerged lands authorizations, water use permits (consumptive use permits), Everglades Works of the District permits, Lake Okeechobee Works of the District permits, and postpermit compliance monitoring for all permitting programs. The Regulation Program also includes additional efforts including: Development of Regional Impact/Siting/Coastal Zone Management; power plant and transmission line siting; ongoing rule development; and automation support.

Program 5. Outreach

Definition

This program includes all water resource education activities, such as water conservation campaigns and water resource education; public information activities; all lobbying activities relating to local, regional, state, and federal governmental affairs; and all public information activities, including related public service announcements, and advertising in any media.

General Description

This program captures activities and initiatives designed to implement and support water management goals and programs, including public information, community events, water conservation, adult and youth water resource education, intergovernmental coordination and cooperation, technical assistance, and cooperative agreements.

Program 6. District Management and Administration

Definition

This program consists of the District's functional support services including the following: administrative support, executive management, legal support, service center administration, budget, procurement, supplier diversity, inspector general/internal audit, information technology and infrastructure management/support, financial management, risk management, and human resource management.

General Description

Work in this program area supports the water resource line organizations and plays a key role in accomplishing District water resource goals and objectives through providing financial and human resources expertise; legal advice, counsel, and representation; procurement; information technology management; and accountability and risk management functions. These activities are vital for effective management, informed decision making and mandatory/statutory compliance. The program provides value-added strategies, resources, and systems to customers for timely planning, organization, direction, and evaluation. The functions in this program area cross a number of support departments and offices.

NATURAL SETTING

The topography of South Florida, like that of the state as a whole, is the result of sediment deposition and solution related processes that have sculptured the land over time. Average rainfall is about 53 inches per year, and intense storms, yielding large volumes of rainfall, are common. The District's present surface hydrology is largely governed by man-made systems superimposed on the natural hydrology of the region. The Biscayne and the Floridan aquifers underlie much of the region and are highly productive.

Topography and Physiographic Features

Nearly all the land in South Florida is less than 100 feet above mean sea level (msl). Land surface generally slopes from north to south. The coastal regions and most of the peninsula south of Lake Okeechobee are very flat and lie below 25 feet msl, except near Immokalee and parts of the Atlantic Coastal Ridge. North of Lake Okeechobee, the Lake Wales Ridge juts down the center of the peninsula and is mostly above the 100-foot contour. East of this ridge, the Okeechobee Plain rises from approximately 20 feet msl at the lake to 30 to 40 feet msl at the edge of the Osceola Plain, which rises in elevation from 60 to 90 feet.

The Kissimmee River valley crosses the Osceola and Okeechobee plains and is a major source of surface water to Lake Okeechobee and the Everglades. Rainfall in the northern portion of the Osceola Plain recharges the Floridan aquifer. The Immokalee Rise provides recharge to the water table and sandstone aquifers in Lee and Collier counties.

Lake Okeechobee, located in the heart of South Florida, is the third largest freshwater lake entirely in the United States. It was formed about 6,000 thousand years ago and is the central component of South Florida's interconnected Kissimmee River-Lake Okeechobee-Everglades ecosystem.

The Everglades is a resource of global significance. It is an extensive system of highly productive wetlands, habitat for numerous species of tropical and subtropical plants and animals, and a vast reservoir of fresh water. The term "Everglades" refers to the swamps, marshes, sloughs, prairies, tree islands, and forests that covered most of southeastern Florida west of the Atlantic coastal ridge.

Water from the Atlantic Coastal Ridge and the Everglades recharges the Biscayne aquifer in Miami-Dade and Broward counties and provides surface water flows to Florida Bay. The Big Cypress Swamp in eastern Collier and southern Hendry counties contributes primarily to surface water flow to coastal estuaries along the southwest coast of Collier County and Everglades National Park. The Florida Keys have no major source of fresh water except for rainfall and limited storage in the shallow aquifer of the larger islands. Coastal marshes and mangrove swamps, which are subject to tidal influx of salt water, border the southern end of the peninsula. The topographic and physiographic regions within the District are shown in **Figures 7** and **8**.

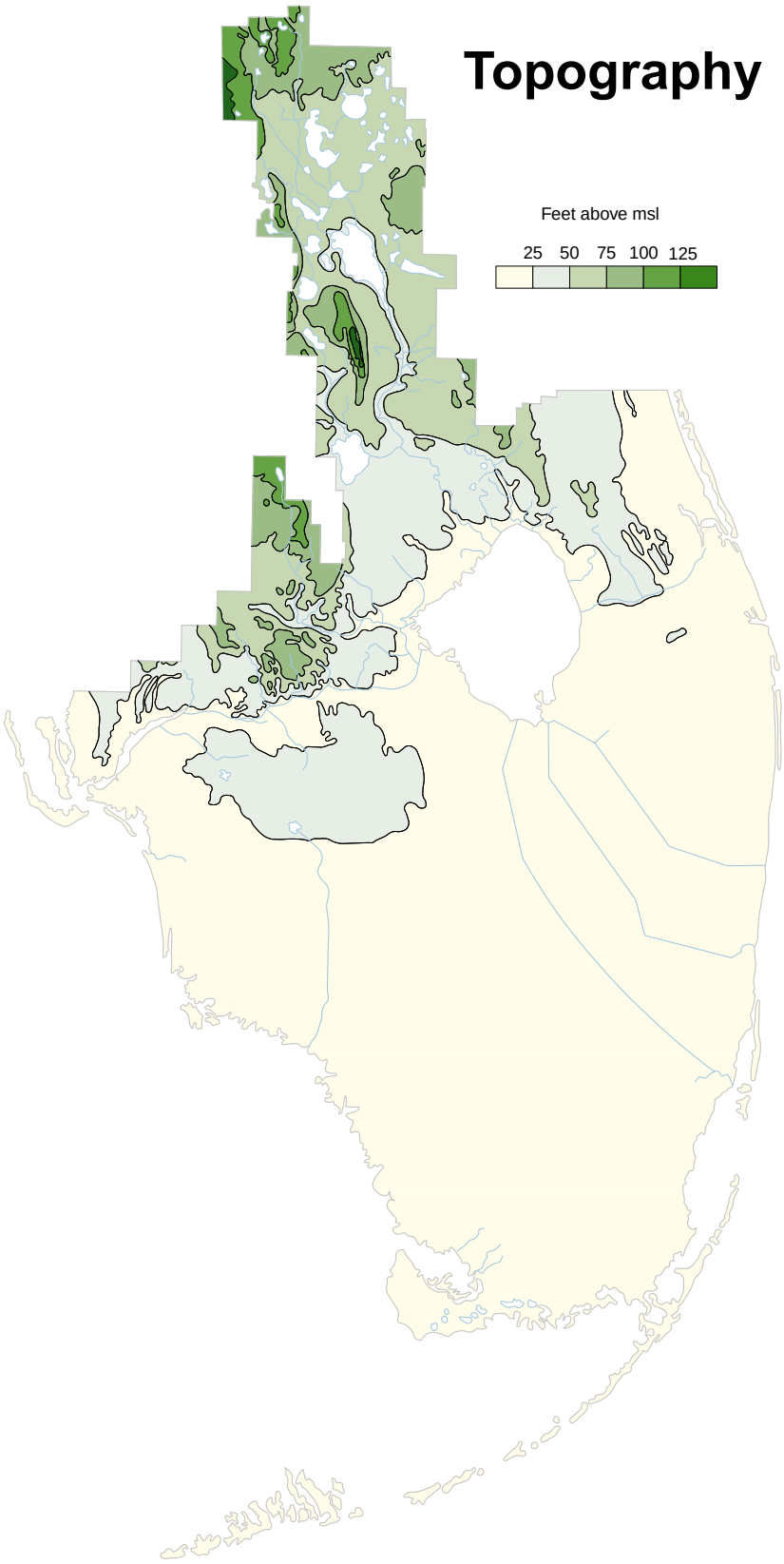


Figure 7. Topography within the SFWMD (Fernald and Purdam, 1998).

Physiographic Regions

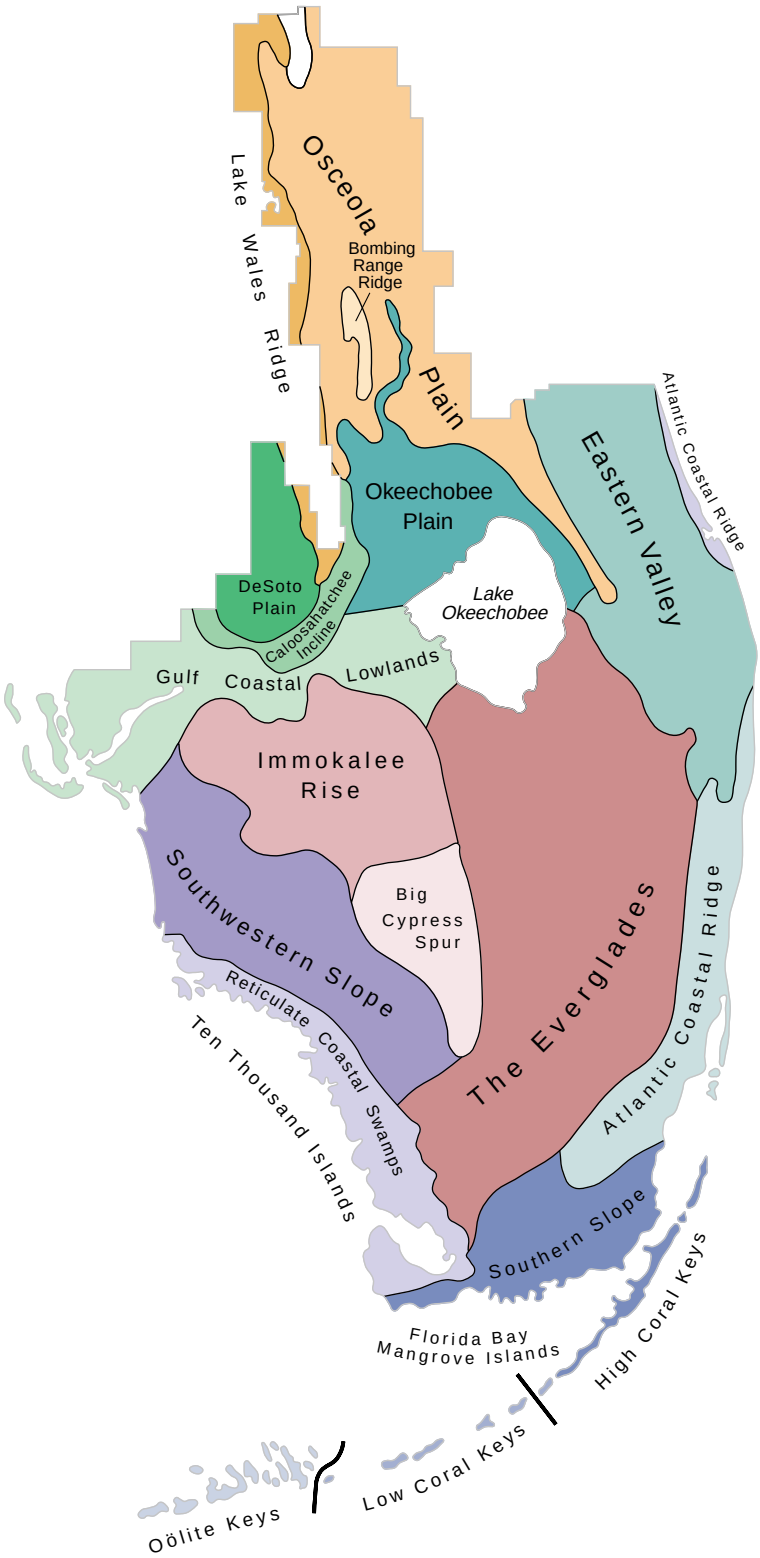


Figure 8. Physiographic Regions within the SFWMD (Fernald and Purdam, 1998).

Climate

The climate of South Florida is characterized by warm temperatures, an average annual rainfall of 52.8 inches, and usually light winds. Intense storms, yielding large volumes of rain are common. Seventy-three percent, or 38.5 inches, of the region's spatially averaged annual rainfall occurs in the six month period from May through October (Ali and Abtew, 1999). During the dry months, rainfall is more closely related to the passage of cold fronts and warm fronts. These frontal storms produce significant rainfall, but occur with less frequency than the wet season, summer storms. The monthly average rainfall distribution for the District is shown in **Figure 9**. Results from rainfall analysis conducted by the District show a significant variation around the historical mean for all basins and all months.

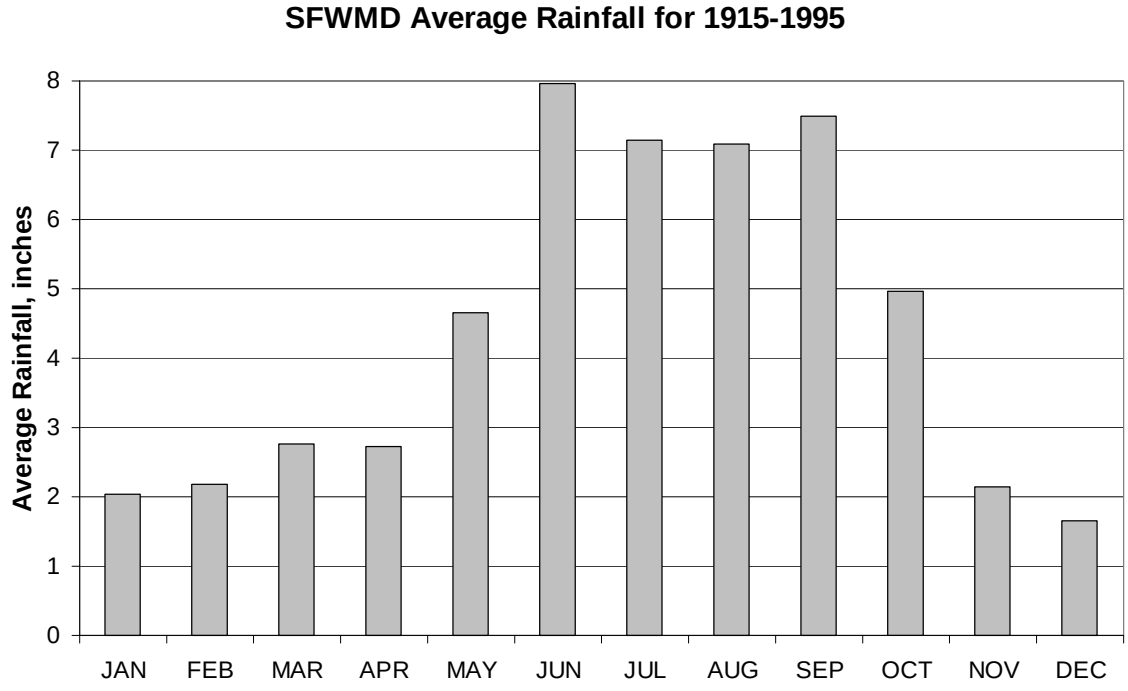


Figure 9. Monthly Distribution of Average Rainfall within the SFWMD.

In addition to the average seasonal variation of rainfall, year-to-year variability in total precipitation is an important feature of South Florida's climate. Annual District rainfall frequency analysis performed by Sculley (1986) depicted 1-in-10 year dry and wet annual District rainfall as 44.3 and 62.5 inches, respectively. Spatially averaged District rainfall quantities for the years 1915 through 1995 are shown in **Figure 10**. Annual rainfall fluctuates significantly from year-to-year, and the fact that South Florida can move so quickly from having excessive rainfall with associated flooding to a drought situation, or vice versa, exacerbates the difficulties associated with managing the water resources of the region.

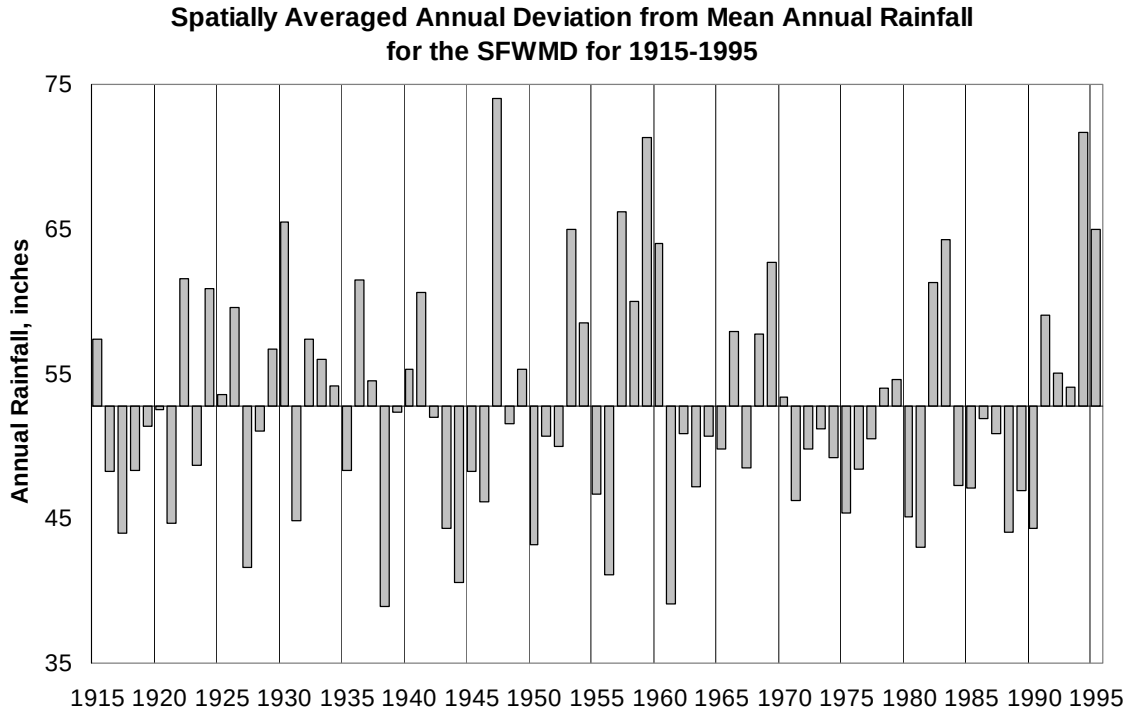


Figure 10. Spatially Averaged Annual Deviation of Rainfall from the Mean within the SFWMD.

SURFACE WATER RESOURCES

The natural surface hydrology of South Florida resulted from the interaction of the region's subtropical climate with its topography and geology. The natural hydrologic system was self-sustaining and dynamic with conditions ranging from dry periods to prolonged flooding during wet periods. During wet periods, water tended to accumulate on the predominantly flat, low-lying lands, flowing overland and via shallow streams into freshwater lakes and the ocean. Ponding persisted for several months, allowing infiltration of surface water into the underlying aquifers. During dry periods, surface water levels receded, but water stored in the soil and aquifer provided base flow for the rivers and wetlands. Occasionally, prolonged droughts caused more complete drying of the land. Wildfires were common during droughts.

Long periods of flooding and the extremes of droughts and hurricanes made most of South Florida inhospitable to development. Early development was generally confined to isolated uplands and the coastal ridge, which was often the only dry land available. There was, however, a strong desire to settle the lowlands, which were very fertile and had the potential to be of great agricultural value. In order to accommodate development, the natural hydrologic system was modified to enable agricultural and urban development. Extensive damage wrought by floods and droughts on urban and agricultural areas led to the construction of the C&SF Project and other surface water management systems managed by the District. A schematic of this surface water management system is shown in **Figure 24** in **Chapter 4**, and in detail on the *Structure and Canal Locations* map

inserted in this document's front cover. The region's surface hydrology is now largely governed by man-made systems superimposed on the District's natural hydrology. The boundaries of the District's major surface water basins, based on drainage divides, are shown in **Figure 11**.

Upper Kissimmee

The Upper Kissimmee Basin is dotted with hundreds of lakes, ranging in size from small sinkholes and ponds to large lakes. The surface water drainage pattern begins with a series of interconnected lakes in the northern portion, called the Kissimmee Chain of Lakes. Alligator Lake forms the drainage divide of the Chain of Lakes and water can be released either to the north or to the south. Northward flow goes though several canals and smaller lakes to Lake Mary Jane; the flow proceeds through Lakes Hart, East Tohopekaliga, and Tohopekaliga, then finally to Lake Cypress. Southward flow takes a shorter route through Lake Gentry and then to Lake Cypress. From Lake Cypress, water flows southward to Lake Hatchineha and then to Lake Kissimmee. Most of these lakes are shallow, with mean depths varying from six to 13 feet. The subbasins of the Upper Kissimmee Basin are generally delineated by the drainage divides of the major water bodies, and more detailed descriptions of these lakes may be found in the *Kissimmee Basin Water Supply Plan* (SFWMD, 2000a).

Okeechobee

The Okeechobee Basin includes the tributary watersheds of the Kissimmee River between the outlet of Lake Kissimmee (S-65) and Lake Okeechobee. There are a series of five subbasins (S-65A through E) along the C-38 Canal. These subbasins are named after the structures which divide the C-38 Canal into five pools. The water level in each of these pools is regulated according to an interim regulation schedule for the Kissimmee River Pools.

Lake Okeechobee is the largest lake in Florida and the third largest natural water body entirely within the United States. This lake and its associated wetlands provide habitat for a number of plants and animals, including several rare and endangered species such as the wood stork, snail kite, West Indian manatee, and Okeechobee gourd. Migratory birds and waterfowl use the littoral zone and adjacent wetlands as a resting area along the Atlantic flyway. The lake is also a major recreational resource. The lake supports a nationally renowned sport fishery, and is an important winter waterfowl hunting area. It is also part of the navigable Okeechobee Waterway connecting the east and west coasts of the state.

Lake Okeechobee also provides water storage for urban and agricultural water supply. During water shortages, canal discharges from Lake Okeechobee provides recharge water for the Biscayne aquifer, indirectly supplying water to 90 percent of the five million residents of the LEC planning region. The lake also supplies irrigation water for sugarcane, vegetables, sod, and rice crops grown in the EAA.

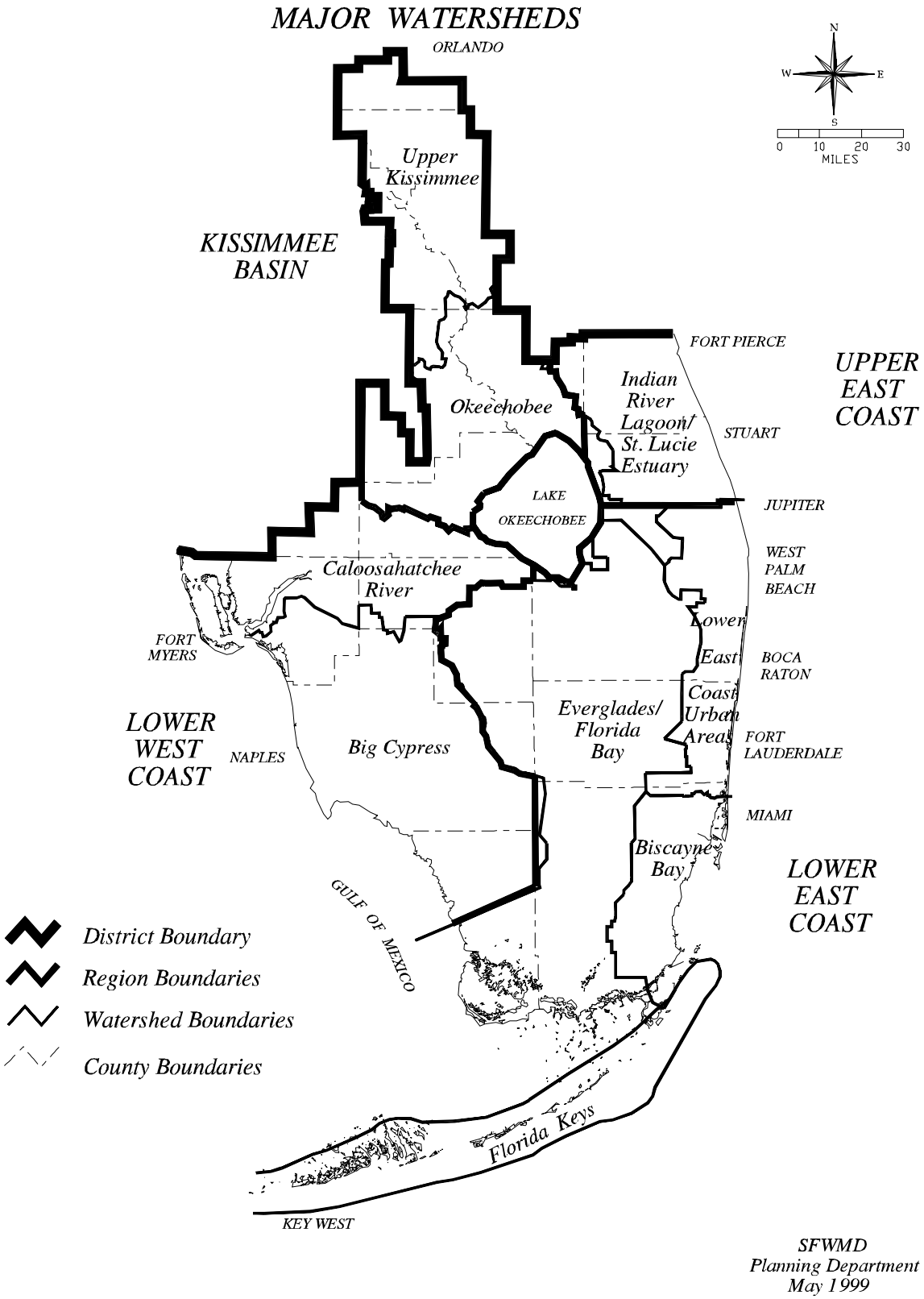


Figure 11. Major Surface Water Basins within the SFWMD.

Lake Istokpoga is the second largest lake within the District (fifth largest in the state) and is also within the Okeechobee Basin. This lake has a surface area of 43.3 square miles, and ranges in depth from 4.3 to 9.8 feet. Lake Istokpoga is known for the excellent fishing it offers, and represents 60 percent of the public access fresh water in Highlands County.

Caloosahatchee River

The Caloosahatchee River Basin extends from Lake Okeechobee to San Carlos Bay. It comprises the northern portion of the LWC planning region. Inflows from Lake Okeechobee and runoff from within its own basin supply the Caloosahatchee River. The freshwater portion of the river (C-43 Canal) extends eastward from the Franklin Lock and Dam (S-79) towards Lake Okeechobee and the cities of LaBelle and Moore Haven. The C-43 Canal is part of the Lake Okeechobee Waterway that provides navigation between the east and west coasts of Florida. West of the S-79 Structure, the river mixes freely with estuarine water as it empties into the Gulf of Mexico. The river is the only major surface water source used for water supply in the LWC planning region.

Big Cypress Basin

The Big Cypress Basin includes all of Collier County and part of Monroe County; including the Big Cypress National Preserve and the Ten Thousand Islands. The regional hydrologic system in the Big Cypress Basin is made up of natural sloughs, rivers, and wetlands. In some areas, local drainage canals provide limited regional flood protection during wet periods, but also lead to overdrainage during dry periods. Development in downstream coastal areas has degraded many natural flowways and their flood carrying capacities; leading to increased flooding in inland areas. The District, through its Big Cypress Basin Board, has adopted many of these canals as works of the Big Cypress Basin and has modified them to reduce overdrainage while maintaining flood protection.

Indian River Lagoon

The Indian River Lagoon Basin is composed of three interconnected estuarine lagoons: the Mosquito Lagoon, Indian River Lagoon, and the Banana River Lagoon. The lagoon system extends about 155 miles through six coastal counties from Ponce de Leon Inlet in Volusia County southward to Jupiter Inlet in Palm Beach County. For planning purposes, the watershed has been divided into four geographic segments. The North, North Central, and South Central segments are within the St. Johns River Water Management District. The South segment is within the SFWMD and is divided into drainage basins based on hydrologic characteristics. These drainage basins are the C-23, C-24, C-25, and C-44 canal basins and the basins which drain into the North and South Fork of the St. Lucie River.

The South Indian River Lagoon segment, under natural conditions, was poorly drained with many isolated wetlands. The natural drainage divides are poorly defined. The area has been developed for agriculture and urban/residential uses with a complex system of drainage canals. Many of these canals provide connections between basins.

Lower East Coast Urban Area

The LEC Urban Area consists of the coastal ridge portions of Palm Beach and Broward counties lying east of the WCAs, and is part of the most densely populated part of the state (together with Miami-Dade County). The largest population centers are near the coast and include the cities of West Palm Beach, Fort Lauderdale, and Hollywood. Water levels in coastal canals are controlled near the coastal shoreline to prevent overdrainage and to resist saltwater intrusion.

Low water levels in the canals east of the control structures enable salt water to migrate into the ground water, wellfields, and natural freshwater systems upon which the urban areas depend for a potable water supply. Except for pockets of publicly protected preservation lands, extensive development has resulted in nearly the complete urbanization of the coastal region, from West Palm Beach southward through Hollywood.

Everglades - Florida Bay

The Everglades is the largest subtropical wetland in the United States and a unique resource for South Florida. Everglades National Park was established in 1947, designated an International Biosphere Reserve in 1976, an Outstanding Florida Water in 1978, and a United Nations World Heritage Site in 1979. The park and the WCAs are the surviving remnants of the historical Everglades, which spread uninterrupted from Lake Okeechobee south to Florida Bay and east to the coastal ridge. This remaining area provides significant ecological benefits, including water storage and supply, habitat for wildlife of national significance, and internationally recognized recreational opportunities. The Everglades also encompasses the Western Basins area which contains two Native American Indian reservations. Big Cypress, the largest of the Seminole Tribe's reservations, occupies more than 52,000 acres in Hendry and Broward counties. The Miccosukee Tribe's reservation, just south of the Big Cypress reservation, comprises 75,000 acres in Broward County.

To the south, Florida Bay has begun to demonstrate signs of stress. Historically, the bay was a 772 square mile shallow, brackish estuary with fluctuating salinity. Salinity fluctuations were caused by seasonal changes in the outflow from the Everglades, and rainfall. The bay was popular with sport fishermen because of the schools of tarpon, bonefish, redfish, and sea trout feeding on the pink shrimp, crabs, and other bait. Large sections of the estuary have deteriorated in recent years. Hydrologic and geologic indicators of the deterioration of the estuary include murky water, loss of seagrass habitat, algal blooms, fish and invertebrate kills, and significant increases in salinity levels.

Biscayne Bay

The Biscayne Bay Watershed includes the highly urbanized, coastal area of Miami-Dade County. South of Miami the coastal area widens as the Everglades bends to the west. The watershed includes urban and agricultural areas that extend almost to the southern coast. Miami-Dade County’s agricultural industry covers more than 83,000 acres southwest of the coastal metropolitan area. Vegetables, tropical fruits, and nursery plants are grown in this area.

Biscayne Bay is a shallow subtropical estuary with a natural depth ranging from three to nine feet. Much of the upper bay has been modified and dredged, so that depths now average six to ten feet and include some dredged areas and channels up to forty feet deep. A basin of about 840 square miles drains to the bay. Seventeen canals in eastern Miami-Dade County operated by the District provide most of the surface flows of fresh water into Biscayne Bay.

The significance of ground water flows to Biscayne Bay is uncertain. Existing data suggest that historic dry season ground water flows have been greatly reduced. Canal construction has accelerated the rate at which ground water levels recede at the end of the wet season. Before canals and structures existed, some surface water flowed to the bay through the Miami River and a few natural creeks and streams. During wet periods, large amounts of water entered the bay as surface water flowed across adjacent freshwater marshes. Surface water now discharges from the mouths of canals at a much faster rate compared to the flow rate of natural conditions.

Biscayne Bay continues to support a wide variety of plants and animals, some of which are important for fisheries. Many rare, threatened, and endangered species occur in or near the bay, including manatees and crocodiles.

Florida Keys

The Florida Keys watershed consists of a limestone island archipelago of some 1,700 islands extending southwest for over 200 miles, from the southern tip of the Florida mainland to the Dry Tortugas. The area is bounded on the north and west by the relatively shallow mud shoals and seagrass beds of Biscayne Bay, Barnes and Blackwater sounds, Florida Bay, and the Gulf of Mexico. Fresh water is supplied to the Florida Keys by the Florida Keys Aqueduct Authority, which has a wellfield near Florida City on the mainland.

GROUND WATER RESOURCES

The predominant use of ground water in South Florida, especially for potable water supply, has developed due to the high productivity of the aquifers underlying the region. The Biscayne and the Floridan aquifers are among the most productive in the world. The Biscayne aquifer consists of cavernous limestone and is the primary source of drinking water for all municipal water systems in the LEC planning region south of the C-51 Canal in central Palm Beach County. The high permeability and proximity of the Biscayne aquifer to the land surface closely links it with the surface water hydrology. This link is enhanced by the network of canals of the C&SF Project, which can be used for aquifer recharge. The high permeability and land surface proximity also makes the Biscayne aquifer highly susceptible to saltwater intrusion and to contamination from surface sources (SFWMD, 1998b).

With the exception of the northern portion of the Kissimmee Basin (which predominantly uses water from the Floridan aquifer for potable purposes), the counties

within the District generally use shallow ground water supplies to meet their potable water demands. The Public Water Supply (PWS) wellfields are vulnerable to contamination from land based sources and need to be safeguarded.

In 1995, nearly 96 percent of South Florida's public utility supply and 100 percent of its domestic self-supply came from ground water. In addition, ground water accounted for 32 percent of the water used for agricultural irrigation. Overall, ground water supplied 53 percent of the total freshwater demands in the District in 1995 (USGS, 1999). Surface water plays an important role in maintaining the availability of ground water, which is recharged through rainfall and the regional canal system.

Principal Aquifer Systems

Virtually all areas within the District are underlain by aquifers capable of yielding some quantity of water. Three principal aquifer systems exist in South Florida: the Surficial, Intermediate, and Floridan aquifer systems, which are shown in the cross-section of South Florida delineated in **Figure 12**.

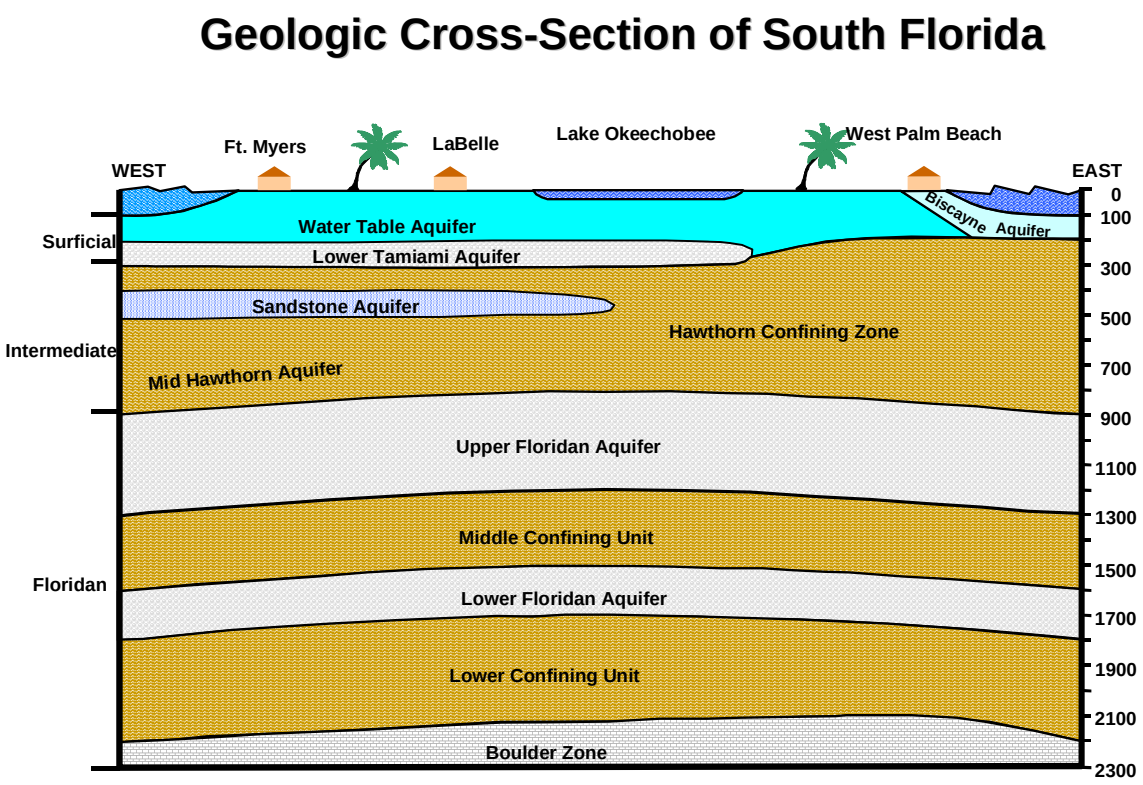


Figure 12. Geologic Cross-Section of South Florida.

The Surficial Aquifer System contains the unconfined Biscayne aquifer located in southeastern Florida (principally Miami-Dade, Broward, and southern Palm Beach counties); the undifferentiated water table aquifers located along the east coast from

St. Lucie County south into Palm Beach County, in parts of south Central Florida, and in the LWC planning region; and the confined lower Tamiami aquifer located in southwestern Florida. The Intermediate Aquifer System contains two major confined aquifers: the sandstone and mid-Hawthorn aquifers located along the southwestern Florida coast from Charlotte to Monroe counties. The Floridan Aquifer System underlies all of South Florida. Everywhere within the District, except in the Upper Kissimmee Basin, Floridan water must be treated extensively before it is potable.

Overall, the Surficial Aquifer System supplied approximately three-quarters of the total ground water withdrawals within the District in 1995. Of the remaining 1995 ground water demands, the Intermediate Aquifer System supplied 11 percent and the Floridan Aquifer System supplied 15 percent.

Surficial Aquifer System

The Surficial Aquifer System includes the Biscayne aquifer, various shallow water table aquifers, and the lower Tamiami aquifer. In general, the water producing zones of the Surficial Aquifer System are composed of interbedded unconsolidated sand and shell units with carbonate rock.

Biscayne Aquifer

The Biscayne aquifer is the major source of fresh water used for PWS within the LEC planning region. The aquifer underlies an area of approximately 3,200 square miles throughout Miami-Dade, Broward, and southern Palm Beach counties. It has been designated a sole source aquifer by the U.S. Environmental Protection Agency (USEPA) under the provisions of the Safe Drinking Water Act and, therefore, must be afforded stringent protection. The sole source aquifer designation is made by the USEPA if 50 percent or more of an area's drinking water is supplied by the aquifer and alternative sources of water are unavailable. By designating the Biscayne a sole source aquifer, the USEPA will preview any federally funded construction projects, such as airports and highways, to ensure that there will be no significant impact on the source of water to residents living in this area.

The Biscayne aquifer is one of the most productive shallow nonartesian aquifers in the United States and one of the most permeable aquifers in the world, displaying transmissivities in excess of 7 million gallons per day per foot (gpd/ft). Many wells yield 1,000 gallons per minute (gpm) or more with negligible drawdowns, because of the exceedingly high permeability of the solution riddled limestones that comprise the Biscayne aquifer. The aquifer is unconfined, close to the surface, and highly permeable, and, therefore, is vulnerable to contamination. Rapid urbanization and agricultural land use are potential contamination threats. The Biscayne aquifer is composed of unconsolidated sand and shell units interbedded with carbonate rocks. The carbonates are the most prolific water producing zones. The aquifer reaches its maximum thickness within the southern portion of the LEC planning region beneath the Atlantic Coastal Ridge and potable water exists to depths of about 200 feet.

Water Table Aquifers

Shallow water table aquifers are the principal water source for urban supply within the LWC and the UEC planning regions. Water table aquifers are also a source of water for agricultural irrigation in these areas.

The water table aquifer system in the LWC planning region has transmissivities ranging between 10,000 to 1,000,000 gpd/ft. In the UEC planning region, the aquifer has transmissivities as high as 200,000 gpd/ft, which decrease abruptly inland. PWS wells in both areas have well yields of about 300 gpm.

The proximity of the water table aquifers to the surface increases their susceptibility to contamination from a variety of sources. Lack of confinement, high recharge rate, relatively high permeability, and a high water table, all increase contamination potential. Because of increasing demands on these aquifers, there is also the threat of saltwater intrusion along the coasts.

Lower Tamiami Aquifer

The lower Tamiami aquifer is the most prolific aquifer in Collier and Hendry counties, serving as the primary source of municipal, industrial, and agricultural water supply. The proximity of the lower Tamiami aquifer to the surface increases its susceptibility to contamination. Because of large demands placed on this aquifer, it has been endangered by saltwater intrusion along the coast and is frequently included in water shortage restrictions.

Intermediate Aquifer System

The Intermediate Aquifer System consists of the sandstone aquifer and the mid-Hawthorn artesian aquifer. It is composed predominantly of interbedded clays and silts, sand, sandstones, dolostones, and limestones. The sandstone aquifer is relatively thin and discontinuous compared to the mid-Hawthorn aquifer, yet it produces more water, particularly for agriculture in Hendry, eastern Lee, and northern Collier counties.

Floridan Aquifer System

The Floridan aquifer serves as a major source for agricultural irrigation water within the UEC planning region, and is also utilized on a small scale as a complementary source for blending with water from the Surficial Aquifer System for PWS. The Floridan Aquifer System provides about 10 percent of total PWS pumpage in the region. Water from the Floridan Aquifer System typically must undergo desalination prior to potable use within the UEC planning region. Transmissivities are typically high, ranging from 100,000 to 500,000 gpd/ft.

Ground water withdrawals for urban and agricultural use within the Kissimmee Basin occur almost exclusively from the Floridan Aquifer System. This predominantly artesian system contains several distinct producing zones and fresh water. The Floridan

Aquifer System is also present in the LEC and LWC planning regions, but the water quality is not high in these regions. Because of the poor water quality, the Floridan aquifer is not a significant source in these planning regions, although there is some use of the Floridan by barrier island facilities in the LWC.

CULTURAL RESOURCES AND DEVELOPMENT

South Florida was in a relatively natural state in 1940, with Miami and Fort Lauderdale as the two primary urban areas. The Kissimmee River Basin and Okeechobee County were major cattle raising areas. Concentrations of agriculture in South Florida were located along the south rim of Lake Okeechobee, near Immokalee, west and south of Miami, and in Palm Beach County.

Extensive flooding in 1947 led to authorization of the C&SF Project by the federal government. The Florida Legislature created the FCD in 1949 to serve as local sponsor for the C&SF Project. Protection from flooding made additional residential areas in South Florida feasible, and the availability of air conditioning made Florida an increasingly attractive place to reside on a year-round basis.

Population

Between 1950 and 1995 the population of the area within the District's boundaries has grown from 0.8 million to 5.8 million. The region also has significant seasonal and tourist populations that are not included in those numbers. The permanent resident population of the District is projected to reach 8.2 million by 2020 (SFWMD, 1998b) (**Figure 13**).

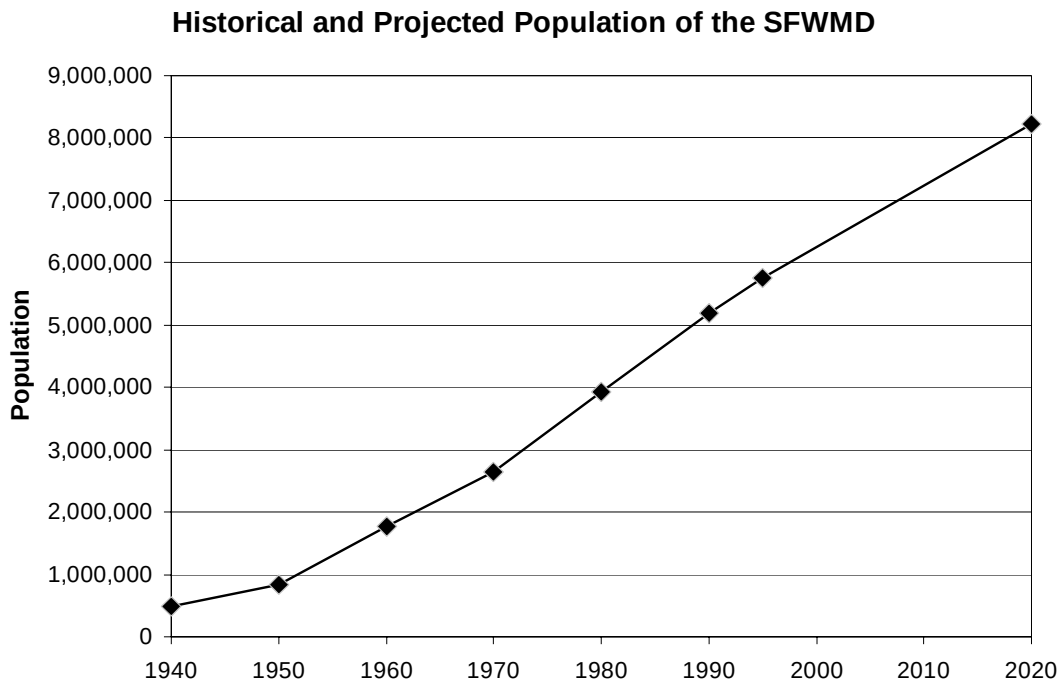


Figure 13. Projection of Future Population within the SFWMD.

Generally, urban development is concentrated along the unprotected areas of the coast and in the I-4 corridor/Orlando area. The 1990 census map, shown in **Figure 14**, clearly depicts the majority of the District's population as residing along the east coast of the District, with significant population centers also on the west coast and in and around Orlando. The assessed 1995 and projected 2020 distributions of population by planning region and county are shown in **Table 2** (SFWMD, 1998b).

Table 2. Assessed 1995 and Projected 2020 Populations for the SFWMD.

Counties	1995	2020	Percent growth
Lower West Coast			
Lee	375,238	594,300	58%
Collier	182,933	349,200	91%
Western Hendry	27,714	39,999	44%
Southern Glades	4,409	7,560	71%
Southeastern Charlotte	645	1,746	171%
LWC Total Population	590,939	992,805	68%
Lower East Coast			
Palm Beach	976,358	1,464,000	50%
Broward	1,412,942	1,926,600	36%
Miami-Dade	2,046,078	2,587,400	26%
Monroe	81,152	106,000	31%
Eastern Hendry	1,871	2,700	44%
LEC Total Population	4,518,401	6,086,700	35%
Upper East Coast			
St. Lucie	171,914	281,500	64%
Martin	110,495	173,500	57%
Eastern Okeechobee	1,048	1,580	51%
UEC Total Population	283,457	456,580	61%
Kissimmee Basin			
Southern Orange	186,131	349,453	88%
Western Osceola	130,605	260,937	100%
Southeastern Polk	6,375	13,832	117%
Eastern Highlands	7,700	11,590	51%
Western Okechobee	28,737	45,244	57%
Northern Glades	3,289	5,640	71%
Kissimmee Basin Total Population	362,837	686,696	89%
District Total Population	5,755,634	8,222,781	43%

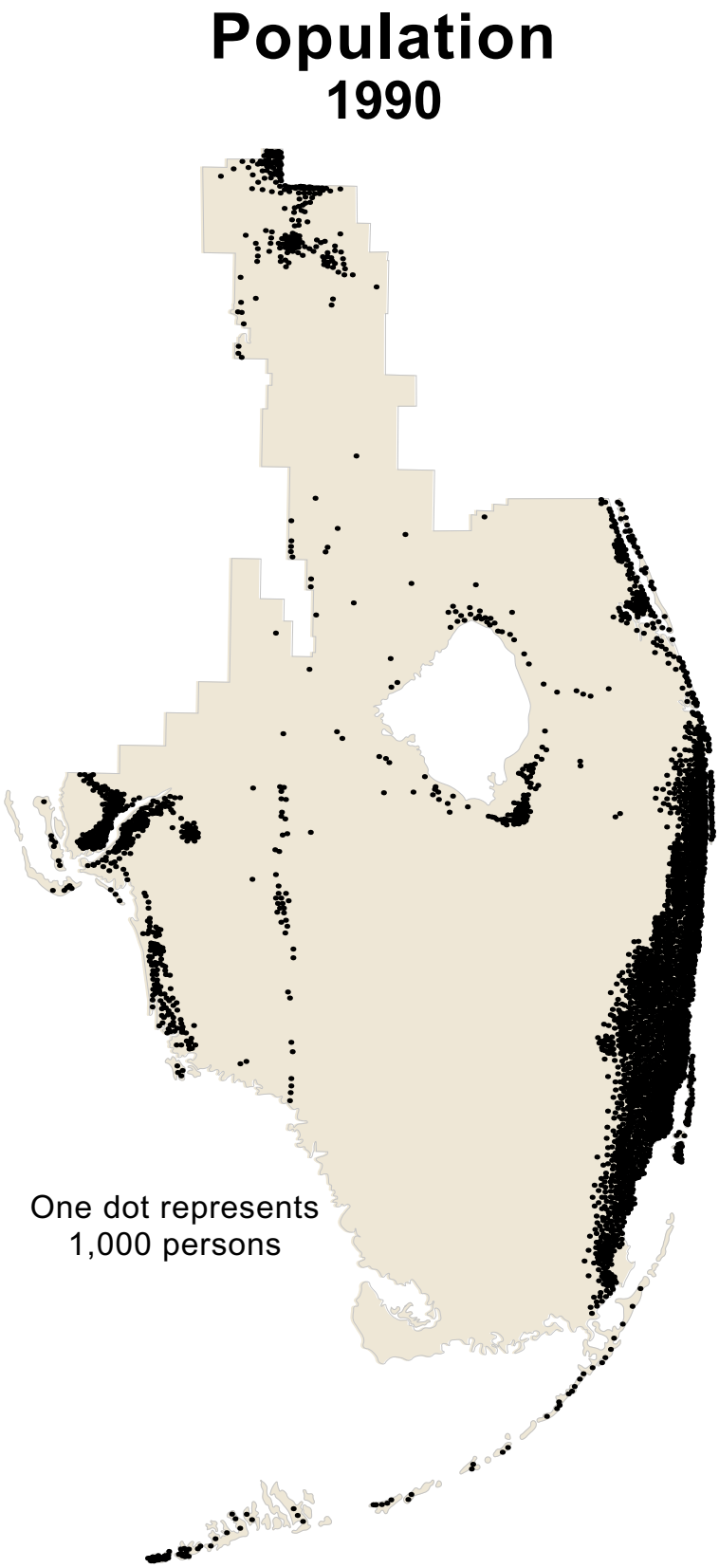


Figure 14. Distribution of Population Density within the SFWMD (Fernald and Purdam, 1998).

Tourism

Tourism plays a major role in the economy of South Florida. Attractions within the District include the beaches of both the Atlantic and Gulf coast; Everglades and Biscayne national park in Miami-Dade and Monroe counties; the Florida Keys; and the theme parks in southwestern Orange and northern Osceola counties.

Tourism results in significant seasonal variations in population. The major tourist season occurs during the dry winter months, and the degree to which the population varies seasonally varies by region within the District. For example, the proportion by which seasonal population shifts in the LWC planning region of the District is much higher than in the Miami area (SFWMD, 1995a).

In spite of large seasonal variations in population the monthly distribution of urban water demand remains fairly constant. During the winter months, the seasonal tourist population is at its peak, whereas outside irrigation demands peak in late spring, when tourist populations are declining. Landscape irrigation demands attributable to seasonal residents take place year-round for properties irrigated by property managers or automated irrigation systems.

Agriculture

Commercial agriculture is a major industry and the main water user within the District. The DWSA (SFWMD, 1998b) describes the irrigated agricultural acreage in each county within the District. Most of the interior area of the District not in public ownership is in agricultural use:

- Sugarcane and vegetable farms in the EAA (Palm Beach, Hendry, Glades, and Martin counties)
- The Agricultural Reserve Area of Palm Beach County
- The South Miami-Dade County Agricultural Area where vegetable crops dominate, especially tropical varieties
- Citrus groves throughout the District, but concentrated in St. Lucie, Martin, Hendry, Highlands, Collier, and Glades counties
- Cattle and dairy farms in Glades, Highlands, and Okeechobee counties

Commercial agricultural crops invariably require irrigation, and the estimation and projection of these irrigation requirements are fundamental to the water supply planning process. For consolidation and comparison purposes agricultural crops were categorized by the Water Demand Projection Subcommittee, which was made up of representatives of Florida's five water management districts. These crop categories are (1) citrus, (2) other fruits and nuts, (3) vegetables, melons, and berries, (4) field crops, (5) greenhouse/nursery, (6) sod, (7) pasture, and (8) miscellaneous. Agricultural acreages reported in this DWMP were taken from the DWSA (SFWMD, 1998b).

Citrus

Citrus is grown commercially within each county in the District except Monroe. While citrus production has historically been concentrated in the central portion of the state, a series of severe freezes during the 1980s resulted in the migration of citrus acreage southward. The three counties in the state with the most acreage planted in citrus, St. Lucie, Polk (a portion), and Hendry counties, are within the District. The region also accounts for virtually all of Florida's lime production (Miami-Dade County). Approximately 391,000 acres within the District were in citrus production in 1995. This acreage includes all categories of citrus (oranges, grapefruit, tangerines, limes, etc.).

Other Fruits and Nuts

Within the District, noncitrus fruit crops (avocados, mangos, papaya, etc.) are produced commercially in Miami-Dade and Lee counties. In 1995, about 10,000 acres were used within these two counties to produce noncitrus fruit crops.

Vegetables, Melons, and Berries

A wide variety of vegetables are grown commercially in South Florida. These include both traditional (e.g., bush and pole beans, carrots, celery, cucumbers, eggplant, endive, escarole, lettuce, peppers, potatoes, radishes, squash, sweet corn, tomatoes) as well as Latin vegetables (e.g., boniato, calabaza, malanga, yuca), and Chinese vegetables (e.g., bok choy, chihilli, napa, Chinese broccoli, dikon). Different types of vegetables are often grown interchangeably and multicropping is a normal practice. Counties with large acreages devoted to vegetable production include Miami-Dade, Palm Beach, Collier, Hendry, and Lee counties. Watermelon production takes place throughout the District, but does not take place on the same land each year due to a viral infestation that occurs in fields after one season of production. Blueberry production takes place in Highlands County. About 157,000 acres within the District were used to produce vegetables, melons, and berries in 1995.

Field Crops

Field crops grown within the District include sugarcane, rice, seed corn, soybean, and sorghum. By far the most significant of the field crops grown within the District in terms of crop acreage is sugarcane, which is grown commercially in Palm Beach, Hendry, Glades, and Martin counties. In 1995, there were about 463,000 acres of land within the District used to cultivate field crops. This does not include sugarcane lands that were fallow that year.

The majority of sugarcane grown in the United States is grown within the District. It is the dominant crop grown on the EAA’s muck soils, and there has been expansion of this crop onto sandland areas west of the EAA. Within the District, about 433,000 acres were planted with sugarcane in 1995. Because of production practices used for sugarcane (ratoon and fallow) there is an additional 25 percent of land used for sugarcane production

which is fallow in any given year. Within the EAA, rice and sweet corn are frequently grown during the fallow periods on the acreage typically devoted to sugarcane production.

Sod

There is some variation in the production practices of sod within the District. Some harvested sod is irrigated, and some is not, serving largely as pasture until the sod is sold. In 1995, there were about 18,000 acres of irrigated sod production within the District.

Greenhouse/Nursery

A variety of greenhouse and nursery crops are grown within the District. Production of ornamentals in South Florida is concentrated near urban areas in Miami-Dade, Palm Beach, and Broward counties, but also takes place throughout the rest of the District. Approximately 26,000 acres were devoted to ornamental nurseries within the District in 1995.

Pasture

Improved pasture has, by District definition, the facilities in place to carry out irrigation. However, these facilities were typically designed for drainage and, with the exception of a very few areas, are very rarely used for irrigation. This is because the returns associated with cattle production do not justify the expense associated with pasture irrigation. When irrigation is carried out, it is usually in a period of extreme drought and is done to prevent grass from dying.

Miscellaneous

The miscellaneous category includes cattle watering and aquaculture. Cattle ranching in South Florida is concentrated in the Kissimmee Basin, especially in Okeechobee, Highlands, and Osceola counties. Both dairy and beef cattle are raised. Aquaculture (fish farming) withdraws water for circulation purposes, and to replace evaporative losses. Commercial aquaculture presently takes place in Collier, Palm Beach, Miami-Dade, Martin, Highlands, and Okeechobee counties.

Land Development

Agricultural and urban land uses have expanded greatly since 1940. A large portion of South Florida is reserved for nature, though much of it has been disturbed. For example, substantial portions of original Everglades wetlands have been protected in the WCAs since the 1970s, but water levels and timing of deliveries have been artificially managed within these impoundments, resulting in adverse effects on native plant and animal communities. **Table 3** and **Figures 15** through **17** show the changing land uses within the District.

Table 3. Changes in Land Use within the District.

	1953		1973		1995	
	Square Miles	Percent	Square Miles	Percent	Square Miles	Percent
Urban	372	2.2%	1,234	7.2%	2,277	13.3%
Agricultural	1,632	9.5%	4,703	27.5%	4,757	27.8%
Natural	14,180	82.5%	10,234	59.9%	8,976	52.5%
Water	997	5.8%	909	5.3%	1,098	6.4%
Total	17,181[a]	100.0%	17,080[a]	100.0%	17,108[a]	100.0%

a. The slight variations in total land use between dates is caused by the difficulty in replicating the mean tide line along the coast.

In 1953, urban land uses made up 2.2 percent of the District's area, and this has increased continuously to 13.3 percent in 1995. In 1953, agricultural land made up 9.5 percent of the District, and this has increased to 27.8 percent in 1995. These changes in land use have had significant impacts to all four of the District's areas of responsibility (water supply, flood protection, water quality, and natural systems). Increased populations and agricultural development have meant increased demands for water supply; increased needs for flood protection; an overall decline in water quality; and a reduction in lands in their natural state.

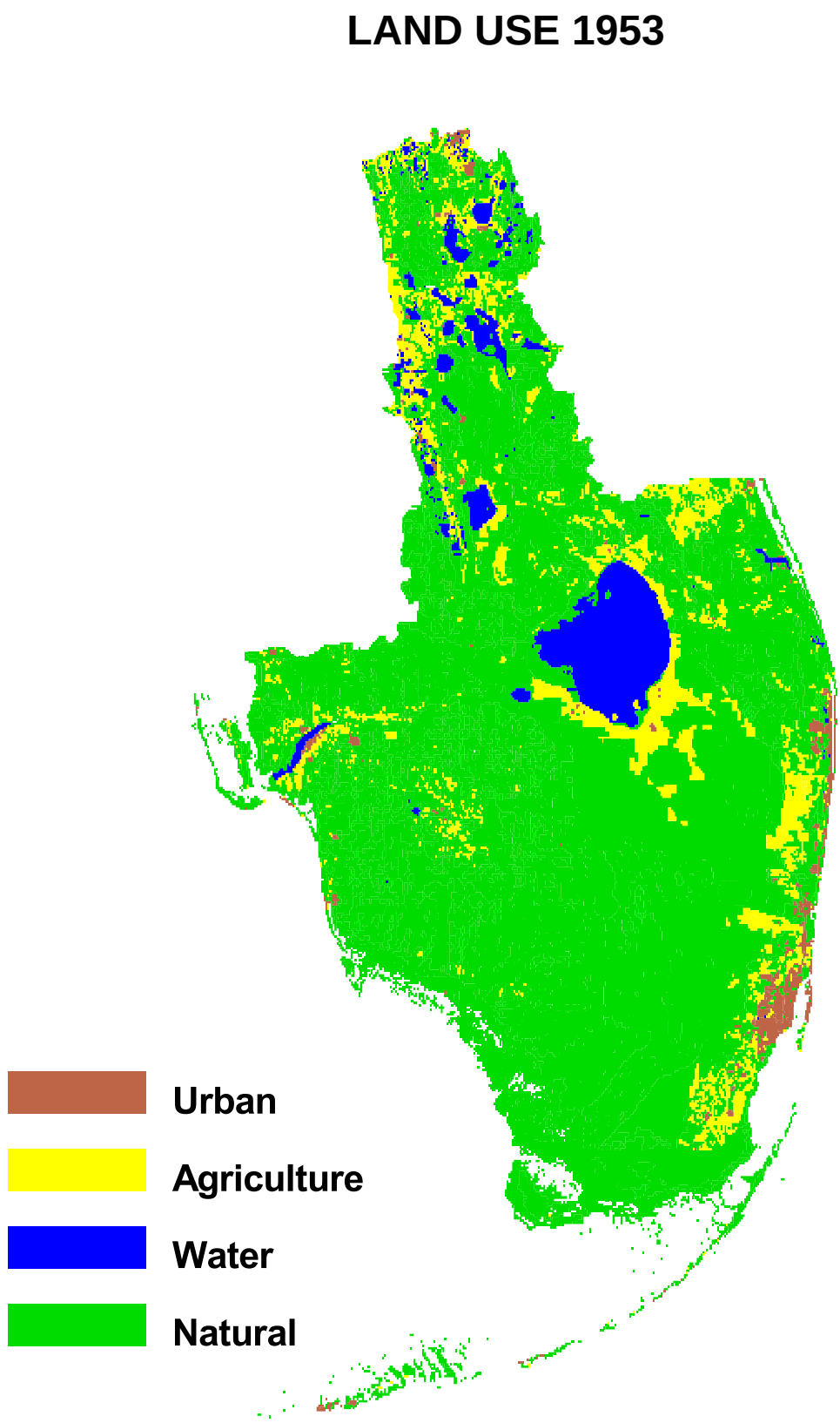


Figure 15. Land Use within the SFWMD in 1953.

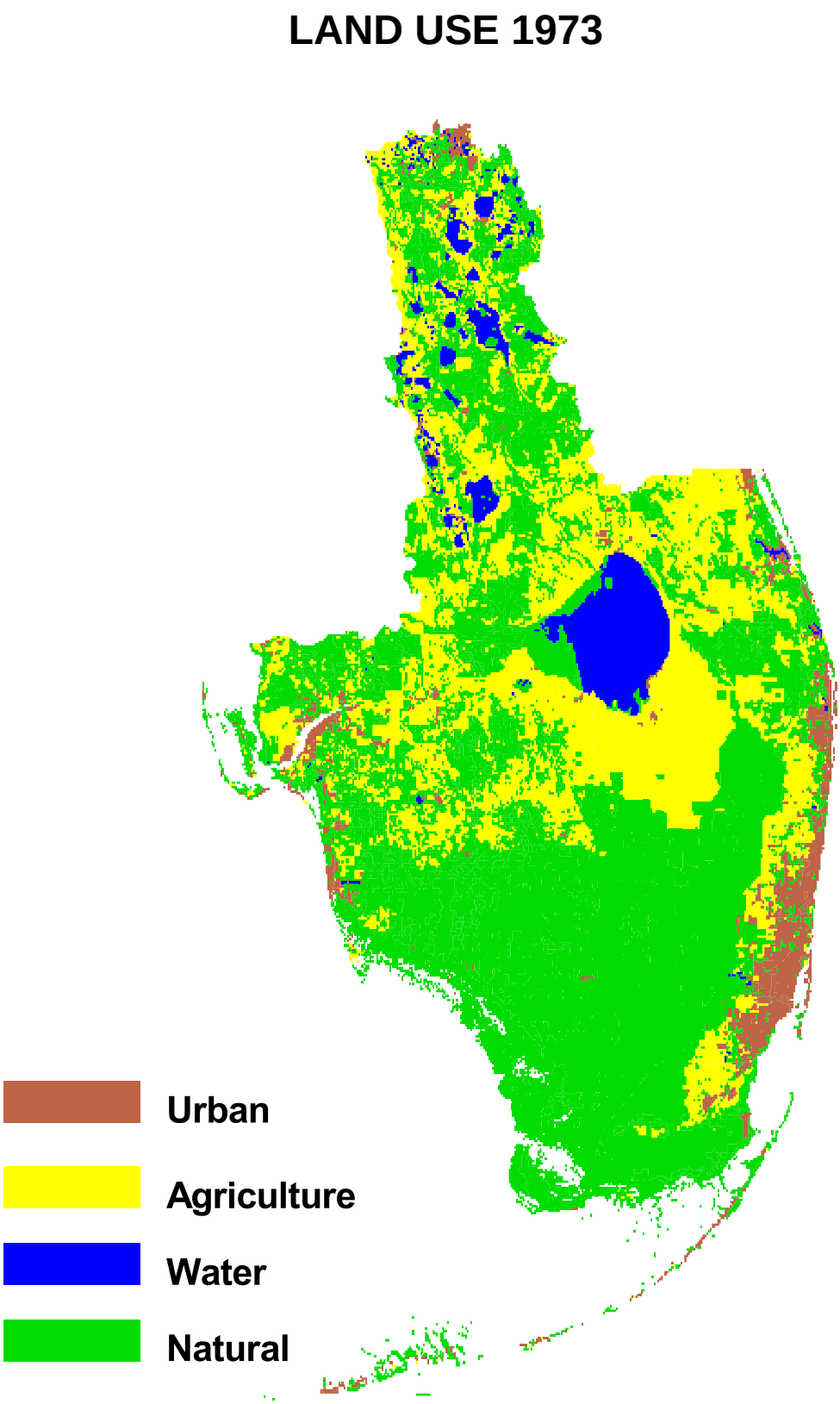


Figure 16. Land Use within the SFWMD in 1973.

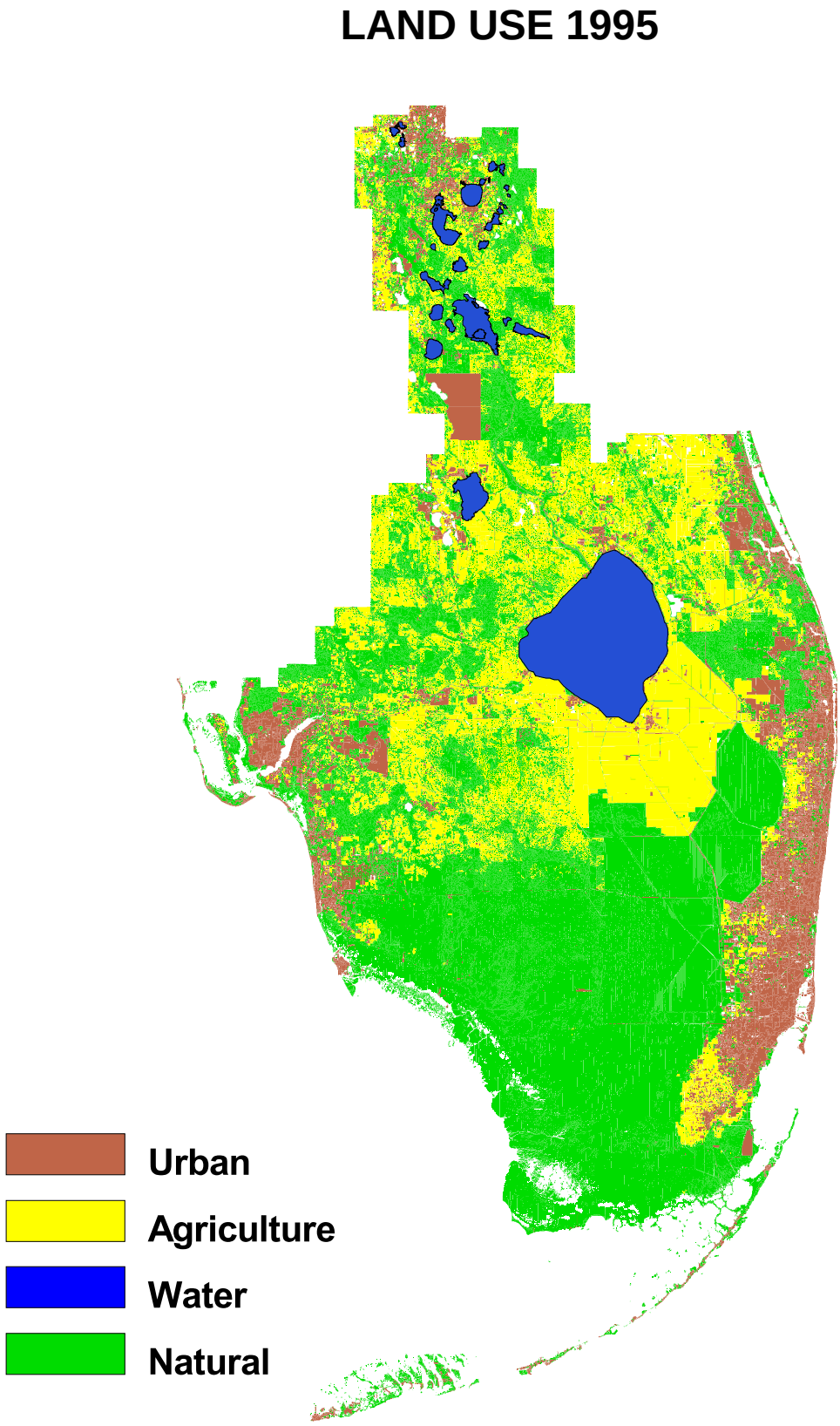


Figure 17. Land Use within the SFWMD in 1995.

Water Use

Demand assessments for 1995 and projections for 2020 are presented in the DWSA (SFWMD, 1998b) for the following water use categories:

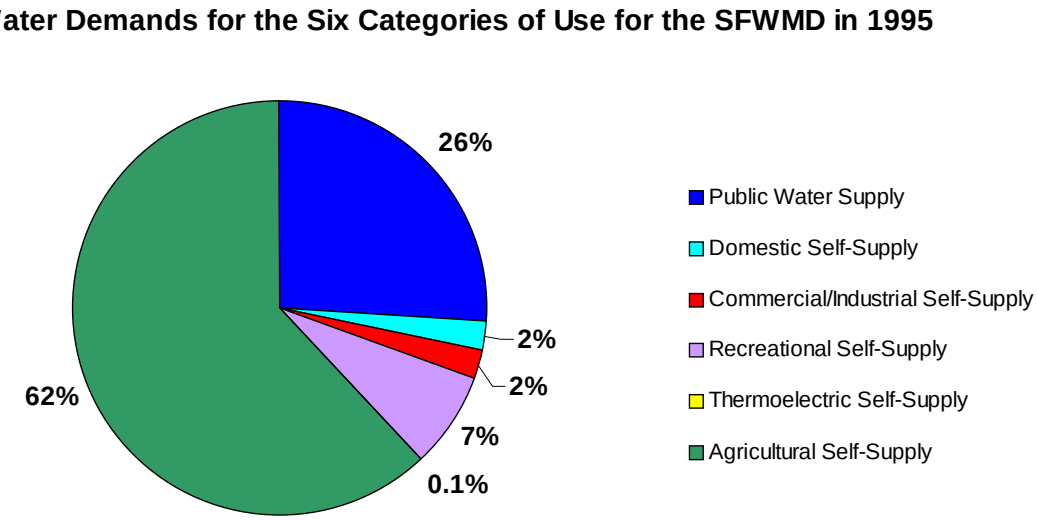
- Public Water Supply
- Domestic Self-Supply and Small Public Supply Systems
- Commercial/Industrial Self-Supply
- Recreational Self-Supply
- Thermoelectric Power Generation Self-Supply
- Agricultural Self-Supply

Districtwide, population residing in the District was assessed at 5,755,634 in 1995, with associated urban demands of 521,011 million gallons per year (mgy), or average daily demands of 1,427 million gallons per day (mgd). Irrigated agricultural acreage in the District was assessed at 1,075,993 acres in 1995 with associated demands of 847,699 mgy, or average daily demands of 2,322 mgd. Actual daily demand levels vary seasonally, especially agricultural irrigation demands.

Total freshwater withdrawals for the entire District were assessed at 1,368,710 mgy in 1995, or an average daily demand level of 3,750 mgd. **Table 4** and **Figure 18** show the average daily withdrawals and percentage of total demands for 1995. Demand projections for 2020, and a more detailed water use analysis may be found in **Chapter 3**, or the DWSA (SFWMD, 1998b).

Table 4. Water Demands for the Six Categories of Use for the District in 1995.

Category	1995 Average Water Demand (mgd)	Percent of Total Water Demand
Public Water Supply	975.3	26.0%
Domestic Self-Supply	91.1	2.4%
Commercial/Industrial Self-Supply	84.3	2.2%
Recreational Self-Supply	273.9	7.3%
Thermoelectric Self-Supply	2.8	0.1%
Agricultural Self-Supply	2,322.5	61.9%
District Total	3,749.9	



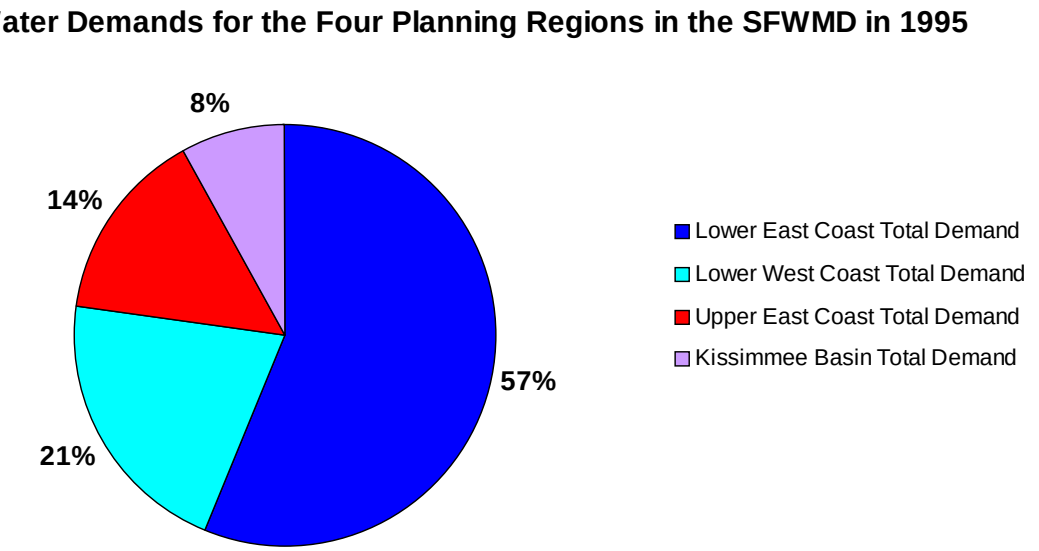


Figure 18. Proportional Distribution Among Six Categories of Water Use in the SFWMD and Among the Four SFWMD Planning Regions.

DISTRICT ACCOMPLISHMENTS SINCE THE 1995 DWMP

The District, in its 1995 DWMP (SFWMD, 1995a), established an ambitious schedule of activities. This schedule called for activities in each area of responsibility in the years following the plan's acceptance. The District has, for the most part, adhered to the schedule of activities described in the original DWMP (**Table 5**). DWMP Annual Reports (SFWMD, 1996, 1997a, 1998a) have included the status of the projects described in the 1995 DWMP. The status of activities for FY2000 is described below.

The 1995 DWMP described 54 District activities that would be under way or completed by the end of FY2000. Of these, 14 are ongoing activities with no fixed end date. Of the remaining 40 activities, two have been superseded or canceled and 23 have been completed. The District is continuing to work on the remaining 15 activities. Nine activities are behind the schedule that was described in the 1995 DWMP, while the remaining six activities are on schedule. If compliance is considered to be one minus the proportion of activities behind schedule, then this represents a compliance rate of 68 percent in 1996, 70 percent 1997, 73 percent in 1998, 70 percent in 1999, and 83 percent in 2000 with the schedule established in the 1995 DWMP.

Among the 54 activities, one group of projects has had schedule adjustments outside of the DWMP process. The District, with approval from the FDEP, developed MFLs Priority Lists and Schedules in December 1998 and 1999. These lists and schedules comply with legislation passed in 1997. Each year's list and schedule include revised schedules for the development of MFLs for water bodies within the District. This is an annual list that maybe changed each year.

If these revised schedules for establishing MFLs are considered (rather than the schedule established in the 1995 DWMP) then the present rate of successful compliance would rise to 93 percent. Brief activity summaries are included in each of the DWMP annual reports (SFWMD, 1996, 1997a, 1998a).

CHANGES IN DISTRICT EMPHASIS SINCE THE 1995 DISTRICT WATER MANAGEMENT PLAN

Coordination between water management districts has been emphasized since the 1995 DWMP. The District has formalized several agreements with the state's other water management districts. These include agreements regarding water resource investigation, planning, regulation, natural systems management, and water shortage declarations. The outlines for several planning efforts, including this DWMP, were coordinated with the other water management districts and the FDEP.

The policies and direction of the District are driven by natural resource needs as interpreted by legislation, and have reinforced the District's efforts and emphasis on its six priority projects. Major water resource legislation since 1994 is described in **Appendix A**.

Table 5. Summary of Activities Since the 1995 DWMP.

	Activity	Status
	Water Supply	
1	Water Use Permitting	Ongoing
2	Conservation Program	Ongoing
3	LEC Regional Water Supply Plan	Complete
4	LWC Water Supply Plan	Complete
5	UEC Water Supply Plan	Complete
6	Kissimmee Basin Water Supply Plan	Complete
7	Northwest Dade Lake Belt Plan	Complete
8	Glades/Highlands County Ground Water Reconnaissance	Behind Schedule
9	Okeechobee Regional Water/Sewer Infrastructure	Complete
10	Recharge Mapping	Complete
11	Prime Recharge Designation	Complete
12	Wellhead Protection Program	Ongoing
	Flood Protection	
13	Canal Conveyance Capacity Study	Complete
14	Key West Storm Water Retrofits	Ongoing
15	Western C-9 Detailed Design Workshop	Complete
16	Big Cypress Basin Assessment (Watershed Management Plan)	Complete
17	Watershed Interactive Network	Complete
18	Lake Istokpoga Study	Complete
19	Okeechobee County Surface Water Management	Complete
20	Boggy Creek Drainage Study	Complete
	Water Quality	
21	Water Quality Monitoring	Ongoing
22	Everglades Surface Water Improvement Management (SWIM)	N/A[a]
23	Everglades Program	On Schedule
24	Upper Kissimmee Chain of Lakes Plan	Behind Schedule
25	Biscayne Bay SWIM	Complete
26	Lake Okeechobee SWIM	Complete
27	Florida Keys Water Quality Plan	On Schedule
28	Florida Keys National Marine Sanctuary Water Quality Program	Ongoing
29	Florida Bay Water Quality Program	Complete
30	Indian River Lagoon SWIM	Complete
31	Miami River Water Quality Commission	Complete
32	Moore Haven Wastewater Feasibility Study	Complete
	Natural Systems Management	
33	Environmental Resource Permitting	Ongoing
34	Save Our Rivers Acquisitions	Ongoing
35	Aquatic Plant Maintenance	Ongoing
36	Melaleuca Task Force	Ongoing
37	Exotic Plant Control	Ongoing

Table 5. Summary of Activities Since the 1995 DWMP.

Activity		Status
38	C&SF Project Comprehensive Review Study (Restudy)/ Comprehensive Everglades Restoration Plan (CERP)	On Schedule[b]
39	Restudy/Indian River Lagoon	Behind Schedule
40	East Coast Buffer/Water Preserve Areas	On Schedule
41	Kissimmee River Restoration	On Schedule
42	Florida Keys Advanced Identification	Ongoing
43	Florida Panther Wildlife Refuge Protection	Ongoing
44	Taylor Slough Demonstration Project	Complete
45	Lake Okeechobee MFLs	Behind Schedule[c]
46	Big Cypress National Preserve	N/A[a]
47	Caloosahatchee Estuary	Behind Schedule[c]
48	Biscayne Aquifer	On Schedule
49	Loxahatchee Estuary MFLs[d] St. Lucie Estuary MFLs[d] UEC Florida Aquifer MFLs[d]	Behind Schedule[c] Behind Schedule[c] N/A[a]
50	Everglades MFLs	Behind Schedule[c]
51	Florida Bay MFLs	Behind Schedule[c]
52	LWC Surficial Aquifer System MFLs	Behind Schedule
General Activities		
53	Comprehensive Plan Review	Ongoing
54	Lake Okeechobee Detailed Design Workshops	Complete

a. N/A indicates that the activity has been superseded or canceled.

b. The Restudy was submitted to Congress on July 1, 1999; The CERP is on schedule.

c. Activity rescheduled with FDEP approval and is on the new schedule.

d. The Loxahatchee Estuary, St. Lucie Estuary, and UEC Floridan Aquifer MFL activities are jointly listed in all DWMP annual reports.

The SFWMD has identified six major efforts as being its main priorities at present and into the foreseeable future. The District has intensified its efforts on those projects since the 1995 DWMP. These efforts are described below (the order does not imply priority level):

- Operation, Maintenance, and Modernization of the C&SF Project
- Regional Water Resource Planning and Implementation
- Kissimmee River Basin Restoration
- Lake Okeechobee Restoration
- Everglades and Florida Bay Restoration
- Comprehensive Everglades Restoration Plan (CERP) (i.e., implementation of the C&SF Project Comprehensive Review Study)

Operation, Maintenance, and Modernization of the C&SF Project

The C&SF Project was designed following the 1947 flood, and the majority of its structures were built in the 1950s and early 1960s. The C&SF Project consists of 292 primary water control structures, 27 pump stations, 1,800 miles of canals, and 2,000 secondary structures. The components of the C&SF Project (which are further described in **Chapter 4**) typically range in age from 30 to 50 years. Due to the age of this infrastructure, the District annually allocates capital funds for the maintenance necessary to provide flood control and water supply readiness. These funds are allocated in the form of individual projects that target major components of the C&SF Project. The projects include improvements and upgrades through automation; pump station repair and restoration; gravity structure repair and restoration; levee repair; and canal conveyance dredging. These funds are not used for capital expansion. Typically, elements of large restoration projects such as the Everglades Construction Project and Kissimmee River Restoration are addressed as separately funded programs.

The C&SF Project system design was based on projected land uses that were primarily agricultural. When the C&SF Project was designed, its primary function was flood protection and water control. The C&SF Project provided additional benefits to water supply, fish and wildlife preservation, and other functions. Since the construction of the C&SF Project, the District's responsibilities have expanded to emphasize other aspects of water resource management. The operational goals have become broader and more complex than the system was originally designed to meet, resulting in the C&SF Project being pushed beyond its original design objectives.

In addition to the canal network and the corresponding structures (spillways, culverts, weirs, and pump stations) required to operate it, the C&SF Project includes Lake Okeechobee and the three WCAs. Lake Okeechobee has a surface area of 730 square miles and a maximum storage capacity of 1.05 trillion gallons (SFWMD, 1997b). The WCAs are set aside for water storage, natural system preservation, and fish and wildlife benefits.

The District presently operates and maintains the C&SF Project to accomplish the following objectives:

- Ensure the reliability and integrity of the system, through routine inspection, maintenance, and replacement of system components (i.e., water control structures, levees, canals)
- Optimize flood protection, water supply, and natural system benefits
- Improve the District's operational ability to anticipate and respond to the water resource management demands on the system, using the best available science and technology

The District has developed and implemented an effective maintenance and modernization program that is continuously evaluated and upgraded. This program has allowed the original components of the C&SF Project to remain in operation.

Realistically, many of the components have met, or are nearing the end, of their design life cycle. Examples include electrical systems and engines of the pump stations, secondary inflow culverts (project culverts) that were installed nearly 40 years ago, and the canals themselves that have accumulated sediment over the past 40 to 50 years.

Much progress is being made through selected projects using limited resources. The principle components of the pump station electrical systems, as of October 1999, have been almost completely replaced. The Canal Conveyance Capacity Program and other multiyear projects are currently in progress. The completion of these and other projects will provide operational reliability for the C&SF Project.

Regional Water Resource Planning and Implementation

This priority includes all water management planning and the implementation of those plans, including this DWMP. Within this category, water supply planning is presently the District's focus. However, the District also has planning efforts that address water quality, flood control, and natural systems. Previous water supply planning efforts by the District include the following: the *Water Supply Needs and Sources Document 1990-2010* (SFWMD, 1992a); the DWSA (SFWMD, 1998b), the *Lower West Coast Water Supply Plan* (SFWMD, 2000c); the *Interim Plan for Lower East Coast Regional Water Supply Plan* (SFWMD, 1998c); the *Lower East Coast Regional Water Supply Plan* (SFWMD, 2000b) the *Upper East Coast Water Supply Plan* (SFWMD, 1998d); the *Kissimmee Basin Water Supply Plan* (SFWMD, 2000a). With the exception of the *Upper East Coast Water Supply Plan*, these planning efforts have had a future planning horizon through 2010. In many cases, however, the demand levels analyzed far exceed the current 2010 projections due to the slowing of population and irrigated agricultural acreage growth rates.

During the 1997 legislative session, significant amendments were made to the Florida Water Resources Act of 1972 (Chapter 373, F.S.) regarding regional water supply planning. Section 373.036(2)(b)4, F.S., required each water management district to prepare a districtwide water supply assessment, and to then prepare water supply plans for regions that are anticipated to have the potential of demand outstripping available supply by 2020. These regional water supply plans identify specific geographical areas that have water resource problems that are critical or are anticipated to become critical by 2020. For these critical areas, the regional plans detail remedial or preventive measures including water resource development projects, water supply development projects, and operational and regulatory strategies. The regional plans also serve as a means of identifying areas where collection of resource data and technical studies are necessary.

The District has committed to preparing water supply plans for each of its four planning regions, which cumulatively cover the entire District. Water supply plans for the planning regions have been sequenced based on the history of water shortage problems in each region. The LWC was the first to be initiated, followed by plans for the LEC, UEC and the Kissimmee Basin. Each plan was developed in conjunction with an advisory committee composed of interested parties and chaired by a Governing Board member.

The District's water supply planning status for the four planning regions is as follows:

- The *Lower West Coast Water Supply Plan* (SFWMD, 2000c) was completed in 2000.
- The *Interim Plan for Lower East Coast Water Supply* (SFWMD, 1998c) was completed in 1998. The analyses within this document was expanded in the *Lower East Coast Regional Water Supply Plan* completed in 2000 (SFWMD, 2000b).
- The *Upper East Coast Water Supply Plan*, meeting the full water supply planning requirements of Chapter 373, F.S., was completed in 1998, and is currently being implemented.
- The *Kissimmee Basin Water Supply Plan* was completed in 2000.

In addition to the regional water supply plans, the District has also initiated the development of several subregional plans. Subregional planning efforts that are being initiated by the District include the *Caloosahatchee Water Management Plan*, the *North Palm Beach County Comprehensive Water Management Plan*, the *Southeast Palm Beach County Integrated Water Resource Strategy*, and the *Eastern Broward County Integrated Water Resource Plan*.

Water quality planning efforts by the District include Surface Water Improvement and Management (SWIM) plans as well as non-SWIM plans that address water quality. Since the SWIM program was initiated in 1987, the District has prepared a priority list of all water bodies within the District. SWIM plans have been developed for the Indian River Lagoon (SFWMD and SJRWMD, 1994), Lake Okeechobee (SFWMD, 1997b), Biscayne Bay (SFWMD, 1995b), and the Everglades (SFWMD, 1992b). The Everglades SWIM Plan was superseded by the Everglades Forever Act. In addition to improvement of water quality SWIM plans have also identified needs for restoration of natural ecosystem functions within the target water bodies. Since 1995, legislative appropriations for the SWIM Program have declined significantly, although the mandate to conduct the program still exists. In addition to SWIM plans, a water quality plan has been developed for the Florida Keys, and a water management plan that addresses water quality is presently being developed for the Kissimmee Chain of Lakes. Flood protection plans have been developed by the District in the past, but presently the only flood plans being prepared are for the Big Cypress Basin and for southern Lee County, although several other planning efforts consider flooding impacts.

District natural system planning efforts include the natural system restoration components of the C&SF Project Comprehensive Review Study (Restudy) and the CERP; the development of MFLs (which are a subset of the regional water supply planning efforts); the development of rainfall-driven schedules for the Everglades; establishing economic and hydrologic needs for the Everglades Protection Area; the South Miami-Dade County Integrated Water Resource Strategy; SWIM Plans; and land management plans for District holdings.

Kissimmee River Basin Restoration

Between 1962 and 1971, as part of the C&SF Project, the meandering Kissimmee River and flanking floodplain were channelized and transformed into a 30-foot deep central drainage canal (C-38), which was compartmentalized with levees and dam-like water control structures into a series of five pools. Channelization was done primarily to provide an outlet canal for draining floodwaters from the developing Upper Kissimmee Basin, but also to provide flood protection for lands adjacent to the river. The construction of the C-38 Canal took 10 years and satisfied the need for greater flood protection throughout the Kissimmee River Basin. But even before the work was complete, area residents and naturalists realized the channelization had destroyed valuable fish and wildlife habitat. Ninety percent of the wading bird population was lost, as was more than 70 percent of the nesting habitat for bald eagles. The once rich fishery was replaced by increasingly dominant populations of rough fish (i.e. fish species considered to be of poor fighting quality when taken on tackle or of poor eating quality).

The Kissimmee River restoration initiative began as a grassroots movement during the latter stages of channelization when concerned citizens and members of the environmental community voiced concerns regarding perceived environmental impacts of the flood control project. Subsequent studies documented the nature of these impacts to the Kissimmee River and its surrounding ecosystem, including the loss of 30,000 to 35,000 acres of wetlands, a major reduction in wading bird and waterfowl usage, and a continuing long-term decline in game fish populations.

These impacts provided the impetus for over 20 years of state and federally mandated restoration related studies, which culminated in the development of a restoration plan that was authorized for implementation as a state-federal partnership in the 1992 Water Resources Development Act. The restoration project will restore over 40 square miles of river and associated floodplain wetlands, and will benefit over 320 fish and wildlife species, including the endangered bald eagle, wood stork, and snail kite.

This will be accomplished by restoring 43 contiguous miles of the 56-mile long flood control canal, and removing two of the five water control structures within this reach of backfilled canal. Spoil banks composed of excavated sand and shell from the original channelization, which occur along the canal, will provide the source of this backfill material. Another important component of the restoration project is to modify the timing of water inflows to the river from the Kissimmee Chain of Lakes. This will be accomplished by raising the high water level in Lakes Kissimmee, Hatchineha and Cypress one foot higher than is currently allowed. This additional storage will provide the ability to reestablish continuous inflows and a more natural seasonal pattern of high and low flows to the restored river.

The total cost of the restoration project is estimated at $490 million, which will be equally cost-shared by the State of Florida and the federal government. Most of the state's fiscal responsibility will occur as land acquisition, through funds provided by the SOR and Preservation 2000 programs. The federal portion of the project cost will be provided

through annual budgetary appropriations. The first phase of canal backfilling began in the summer of 1999, and reconstruction is scheduled to be completed in 2011.

Reestablishment of floodplain wetlands and the associated nutrient filtration function is expected to result in decreased nutrient loads to Lake Okeechobee. It is also possible that restoration of the Kissimmee River floodplain could benefit populations of key avian species, such as wading birds and waterfowl, throughout South Florida by providing increased feeding and breeding habitat and refuge during adverse conditions.

Lake Okeechobee Restoration

Lake Okeechobee is the largest lake in Florida and the key surface water component of the South Florida ecosystem. The lake is extensively managed for flood control, water supply, and recreation, and past water management decisions have significantly impacted the lake and its associated downstream ecosystems (e.g. the Everglades, the Caloosahatchee River and Estuary and the St. Lucie River and Estuary). The initial lowering of its water level and the construction of an encompassing dike greatly modified Lake Okeechobee. These actions reduced its size and isolated it from its original extensive, dynamic system of littoral zone and floodplain. As a result of the managed water levels that existed between the early 1950s to the late 1970s, a new diverse 150-square mile littoral marsh was formed within the now well-defined 730-square mile lake.

Continuing ecosystem problems in Lake Okeechobee are primarily a result of nutrient runoff from ranching, dairy, and agricultural lands; a lake regulation schedule which places water supply and flood control concerns ahead of the ecological health of the lake; and invasion by exotic plants. High water levels and excessive phosphorus inputs have contributed to a significant degradation of the health of the native flora and fauna in Lake Okeechobee. Since 1978, when the regulation schedule for the lake was raised, frequent long periods of high water levels have resulted in significant changes in the native vegetation in the lake's large littoral zone. Excessive phosphorus inflows have increased the in-lake phosphorus concentrations, and contributed to more frequent damaging algal blooms. Major increases have occurred in the populations of blue-green algae and pollution-tolerant, bottom-dwelling animals. Also, sediment has accumulated in the lake that has exacerbated this problem. Exotic plants have displaced large areas of native vegetation in the lake. Major efforts to reduce phosphorus loads have been undertaken and significant progress has been made, particularly in reducing loading from dairies. However, since the average annual phosphorus load to the lake currently exceeds the target by about 100 tons per year, significant restoration work remains.

The Lake Okeechobee Program provides overall coordination of restoration efforts for the lake. It includes efforts on key management issues, including the following: reduction of external phosphorus loads to the lake; evaluation of the feasibility of removing in-lake sediments; effective eradication of exotic plants; and implementation of a modified lake regulation schedule. The District has been working with the USACE in evaluating alternative regulation schedules that might allow lower water levels without

significantly impacting water supply. The USACE is finalizing an Environmental Impact Statement recommending a new regulation schedule.

The District is working with the FDEP to update the current permit for District water control structures discharging into Lake Okeechobee. The intent is to guide implementation of measures necessary to reach phosphorus targets throughout the lake. The permit will be updated through a consent order with requirements that include continuation of regulatory programs in the basin; construction of pilot STAs and large-scale, reservoir-assisted STAs; a feasibility study to remove accumulated sediment in the lake; studies and data collection to reduce modeling uncertainty; and continued research and monitoring. To accomplish these activities, the District modified its Lake Okeechobee Program, beginning in FY2000, in order to expedite initiation of the required actions.

The USACE and the District are continuing programs to control melaleuca in Lake Okeechobee. The District is also researching methods to control torpedo grass. When this research is complete, the FDEP will assist in implementation of the recommended treatment methods.

Everglades and Florida Bay Restoration

Everglades and Florida Bay restoration involves the implementation of the ECP, the Everglades Stormwater Program, the C-111 Project, the Modified Water Deliveries Project, and other aspects of research and management for the Everglades and Florida Bay ecosystem separate from the CERP. Several of these projects derive from the Everglades Forever Act. That act, passed by the Florida Legislature in 1994, is a comprehensive approach to restoration, relying on a combination of construction, land acquisition, regulation, and extensive research and monitoring. Research provides the foundation for understanding and preserving the Everglades ecosystem and restoration efforts are intended to provide nutrient levels in the system that will not adversely impact native Everglades flora and fauna.

Everglades Construction Project

The ECP forms the foundation for the largest ecosystem restoration program in the history of Florida. The ECP is composed of 12 interrelated construction projects located between Lake Okeechobee and the Everglades. The cornerstone of the ECP is a group of six large constructed wetlands totaling over 47,000 acres. These STAs will use natural biological and geological processes to reduce the levels of phosphorus that enter the Everglades to an interim goal of 50 parts per billion (ppb). The Everglades Nutrient Removal (ENR) project, which is a prototype STA, has been operating for three years and is effectively reducing phosphorus levels below 25 ppb. In addition to the STAs, the ECP contains four hydropattern restoration projects that will improve the volume, timing, and distribution of water entering the Everglades. Construction began in 1997, and the last of the STAs is scheduled to be complete in October 2003, with ancillary facilities completed by 2006. The local share of design, construction, and land acquisition costs for the ECP is estimated to be approximately $506 million. When combined with the federal share of

$190 million, this brings the total estimate of capital costs to $696 million through 2006. The operation and maintenance of the ECP is anticipated to cost $133 million through 2014. This brings the total estimated cost of the project to $829 million. As of September 30, 1999, approximately $314 million had been expended for the ECP of which $280 million was nonfederal.

Everglades Stormwater Program

The Everglades Stormwater Program (formerly known as the Non-ECP initiative) was mandated by the 1994 Everglades Forever Act. The purpose of this program is to ensure that water quality standards are met by the end of 2006 at all structures that the District controls and pumps water into, within, or from the Everglades Protection Area, which are not within the ECP. The basins discharging through these structures include existing urban, agricultural, and Indian reservation lands. Compliance with water quality standards will be achieved through implementing the Non-ECP permit, water quality monitoring, water quality improvement strategies, and solutions such as Best Management Practices (BMPs) or construction projects. Other components of the program include a public education campaign and developing a method for reimbursement of expenditures through a special assessment authorized by the Everglades Forever Act.

C-111 Project

The C-111 Project consists of both structural and nonstructural modifications to the existing components of the C&SF Project within the C-111 Basin that promote more natural hydroperiods in Taylor Slough (a freshwater source for Florida Bay) and the eastern panhandle ecosystems of Everglades National Park. The C-111 Project modifications will be designed and operated to store and disperse the flows of water needed for Taylor Slough restoration. This will assist in Florida Bay restoration, as the bay's decline has been associated with a long-term increase in salinity that resulted from the diversion of fresh water away from Florida Bay via the C&SF Project canal system. Land acquisition, design, construction, and operation for the C-111 Project will be undertaken by the District and the USACE under the terms and conditions agreed to in the C-111 Project Cooperative Agreement entered into in January 1995. The USACE is authorized by the Water Resource Development Act (1996) to consider state water quality standards and add water quality features as needed. Total cost is estimated at $147 million. The District is currently obliged to pay 20 percent of construction and 100 percent of land acquisition costs.

Modified Water Deliveries Project

The Everglades National Park Protection and Expansion Act passed by Congress in 1989 authorized the USACE to modify the C&SF Project to improve freshwater deliveries to ENP via Shark River Slough (along with Taylor Slough, the only sources of fresh water for Florida Bay). The Modified Water Deliveries project that resulted from this legislation includes construction of gated culvert structures, concrete headwall structures, spillways, raising a portion of the Tamiami Trail, and flood mitigation of the 8 1/2 square mile area. Total cost of the Modified Water Deliveries Project is estimated at $110 million.

The Comprehensive Everglades Restoration Plan (Restudy Implementation)

The C&SF Project provides water supply and flood protection for the District South Florida's hydrology is now largely governed by a man-made system superimposed on the natural one. Although it has provided for urban and agricultural uses since its inception in 1948, the C&SF Project and the greater-than-expected growth and development that has ensued have unintentionally resulted in extensive damage to the South Florida environment. Over half of the original Everglades have been destroyed and the damage continues. Water is sent to tide through events such as the very wet spring of 1998, involving over 1.4 million acre-ft of emergency Lake Okeechobee flood control releases to the Caloosahatchee and St. Lucie estuaries. These releases caused major environmental, economic, and human impacts in those estuaries and later resulted in a subsequent need for the lost water as the region headed into drought conditions. Without a change to the current design and operation of the C&SF Project, forecasts project the continued loss of uplands; degradation of wetlands, estuaries, and aquatic life; increased water shortages for agricultural and urban uses; increased flooding; and the loss or forced movement of wellfields.

In 1992, Congress authorized the USACE to undertake a reexamination or restudy of the C&SF Project. The purpose of the C&SF Project Comprehensive Review Study (Restudy) was to determine the means by which the C&SF Project can be modified to restore the South Florida ecosystem, while providing for the other water-related needs of the region. The USACE and the District jointly developed a Project Study Plan for the Restudy, which was approved by the District's Governing Board in July 1995, to provide guidance for all subsequent phases of the Restudy. It was amended in May 1997, following the Water Resources Development Act of 1996. The USACE and the District established a series of interagency Restudy teams that began developing and commenting on Restudy alternatives. This effort started in September 1997 and culminated in June 1998 with the selection of an Initial Draft Plan. On October 15, 1998, the *Central and Southern Florida Flood Control Project Comprehensive Review Study Draft Integrated Feasibility Report and Programmatic Environmental Impact Statement* (USACE and SFWMD, 1998), which contains the recommended comprehensive plan, was released and the USACE and the District immediately began a series of 12 public meetings throughout South Florida to actively solicit public comment on the plan. The *Central and Southern Florida Flood Control Project Comprehensive Review Study Final Integrated Feasibility Report and Programmatic Environmental Impact Statement* (USACE and SFWMD, 1999) was completed in April 1999 and submitted to Congress on July 1, 1999.

The keys to Everglades restoration have been determined in the Restudy to be increase the amount of water available, ensure adequate water quality, and reconnect the parts of the system. A key aim is to annually regain, for beneficial use, about two million acre-feet of excess water currently being discharged to tide for flood control.

The recommendations made within the Restudy (i.e. structural and operational modifications to the C&SF Project) are being further refined and will be implemented in

the Comprehensive Everglades Restoration Plan (CERP). The CERP is intended to be a retrofit and environmental remediation program to satisfy both the needs of the natural system and to provide water supply, flood protection, and quality water for South Florida users. The estimated cost of implementing the recommended CERP is $7.8 billion over approximately 25 years, with an annual operation, maintenance, and monitoring cost of $175 million. The CERP is being equally funded by the State of Florida and the federal government.

Comprehensive Everglades Restoration Plan Goals

The overall goal of the CERP is to enhance ecologic and economic values and social well being. Specific goals which will enhance ecologic value are as follows:

- Increase the total spatial extent of natural areas
- Improve habitat and functional quality
- Improve native plant and animal species abundance and diversity

Specific goals which will enhance economic values and social well being are as follows:

- Increase availability of fresh water (agricultural/municipal and industrial)
- Reduce flood damages (agricultural and urban)
- Provide recreational and navigational opportunities
- Protect cultural and archaeological resources and values

Comprehensive Everglades Restoration Plan Issues

The Restudy identified the following major issues involving the current C&SF Project:

- Too much water is sent to tide
- Estuaries often suffer
- Lake Okeechobee is treated like a reservoir
- The Everglades is not receiving the historic timing and flow of water
- Florida Bay lacks fresh water
- Water quality has deteriorated
- Urban and agricultural water supplies are dwindling
- Flood protection must be maintained

In response to these identified issues, the Restudy was developed to increase South Florida’s water supply, while improving water deliveries to its remaining natural areas.

The Restudy recommends the following modifications to the existing C&SF Project (USACE and SFWMD, 1999):

Developing Surface Water Storage Reservoirs. A number of water storage areas will be located north of Lake Okeechobee, in the Caloosahatchee and St. Lucie basins, in the EAA, and along western Palm Beach, Broward, and Miami-Dade counties. These areas will store 1.5 million acre-feet of water so that it is not sent to tide.

Creating Water Preserve Areas. Multipurpose water management areas are planned in Palm Beach, Broward, and Miami-Dade counties between urban areas and the eastern Everglades. The Water Preserve Areas will have the ability to treat urban runoff, store water, reduce seepage, and improve existing wetland areas.

Managing Lake Okeechobee as an Ecological Resource. Lake Okeechobee is presently managed for many, often conflicting, uses. The lake's regulation schedule will be changed to reduce the extreme high and low levels that harm the ecology of the lake and its shoreline.

Improving Water Deliveries to Estuaries. Excess rainwater that is discharged to the sea through the Caloosahatchee and St. Lucie rivers is very damaging to the estuary ecology. The recommended plan will greatly reduce these discharges by storing excess rain water in surface and underground water storage areas. In addition, during times of low rainfall, stored water can be retrieved to augment the estuaries.

Developing Underground Water Storage. More than 300 wells will be built to reach the Floridan aquifer. As much as 1.6 billion gpd may be pumped through the wells into underground storage zones. The injected fresh water forms a bubble within the existing underground salt water, and can remain in the same condition in which it was injected for years. During dry times it can be pumped out. This approach, known as Aquifer Storage and Recovery, or ASR, has been used for years on a smaller scale to augment municipal water supplies. A significant amount of water in surface reservoirs is lost through evaporation, and a major advantage of ASR is that water does not evaporate when it is underground. The recommended plan includes 200 wells around Lake Okeechobee, as well as others in the Water Preserve Areas and the Caloosahatchee Basin.

Developing Treatment Wetlands. About 30,000 acres of STAs, will be built to treat urban and agricultural runoff water before it is discharged to natural areas. These are in addition to the over 40,000 acres of man-made wetlands already being constructed to treat water discharged from the EAA.

Sending Water to the Everglades in a Way That Mimics Nature. Additional changes will be made to the rainfall-driven operational plan to improve the timing of water sent to the WCAs and Everglades National Park.

Removing Barriers to Sheetflow. More than 240 miles of C&SF Project canals and levees will be removed to reestablish the natural sheetflow of water through the Everglades. Most of the Miami Canal in WCA-3 will be removed. Twenty miles of the

Tamiami Trail (U.S. 41) will be rebuilt with bridges, allowing water to flow as a sheet into Everglades National Park, as it once did naturally. In the Big Cypress Preserve, a north-south levee will be removed to restore some natural overland water flow.

Storing Water in Quarries. Two limestone quarries in northern Miami-Dade County will be converted to water storage reservoirs to supply Florida Bay, the Everglades, and Miami-Dade County residents with water. The area will be ringed with an underground wall to ensure that stored water does not leak.

Reusing Wastewater. The recommended plan includes two advanced wastewater treatment plants in Miami-Dade County. The plants will be capable of making more than 220 mgd of the county's treated wastewater clean enough to discharge into wetlands along Biscayne Bay, and improve water supplies to southern Miami-Dade County and northeastern Shark River Slough (part of the Everglades).

Improving Water Deliveries to Biscayne Bay. The recommended plan will protect and restore Biscayne Bay coastal wetlands and treat storm water runoff before it enters the bay.

Improving Freshwater Flows to Florida Bay. Improved water deliveries to Shark River Slough, Taylor Slough, and the wetlands to the east of the Everglades National Park will send more fresh water to Florida Bay

INFRASTRUCTURE PROJECTS

The District, through the Restudy, has identified a series of water management infrastructure projects (**Figure 19**) that are necessary to accomplish these six major District priorities.

Legend for Figure 19 - Infrastructure Requirements

1. **Kissimmee River Restoration**
2. **North of Lake Okeechobee Storage Reservoir**
3. **Caloosahatchee Estuary Water Supply**
4. **Caloosahatchee Reservoir with ASR and Caloosahatchee Backpumping with STA**
5. **Taylor Creek/Nubbin Slough Storage Reservoir and Treatment Area**
6. **Indian River Lagoon Water Preserve Areas: Storage in the C-23, C-24,C- 25, C- 44, N. and S. Fork Basins**
7. **Revised Lake Okeechobee Regulation Schedule**
8. **St. Lucie Estuary Water Supply**
9. **Lake Okeechobee ASR**
10. **L-8 Project**
11. **WCA-1 Internal Canal Structures**
12. **STA Construction**
13. **EAA Storage Reservoirs**
14. **Modify G-404 and S-140 Pumps**
15. **Water Preserve Areas: Aboveground Storage, ASR, and Seepage Management**
16. **Big Cypress/L-28 Interceptor Modifications**
17. **Partial Decompartmentalization of WCA-3 and Everglades National Park**
18. **LEC Water Conservation and Broward County Secondary Canals Improvements**
19. **Miami-Dade Utility ASR**
20. **Water Preserve Areas: North and Central Lake Belt Storage Areas**
21. **Everglades Rain-Driven Operations**
22. **Modified Water Deliveries**
23. **West and South Miami-Dade County Reuse**
24. **L-31N Levee Improvements for Seepage Management**
25. **Biscayne Bay Coastal Wetlands**
26. **C-111 North Spreader Canal**
27. **Florida Bay Restoration and Other C-111 Projects**
28. **Southern Golden Gate Estates Hydrologic Restoration**
29. **Golden Gate Canal Improvements and ASR**
30. **Lake Trafford Restoration**
31. **Henderson Creek Spreader Canal and Improvements**
32. **Camp Keis Strand Restoration**
33. **WCA-2A Hydropattern Restoration**
34. **WCA-3A Hydropattern Restoration**
35. **Henderson Creek Improvements**
36. **Ten Mile Creek Project**

<u>Other Major Projects (not shown on the map)</u>

Water Resource Development

Critical Restoration Projects

Alternative Water Supply

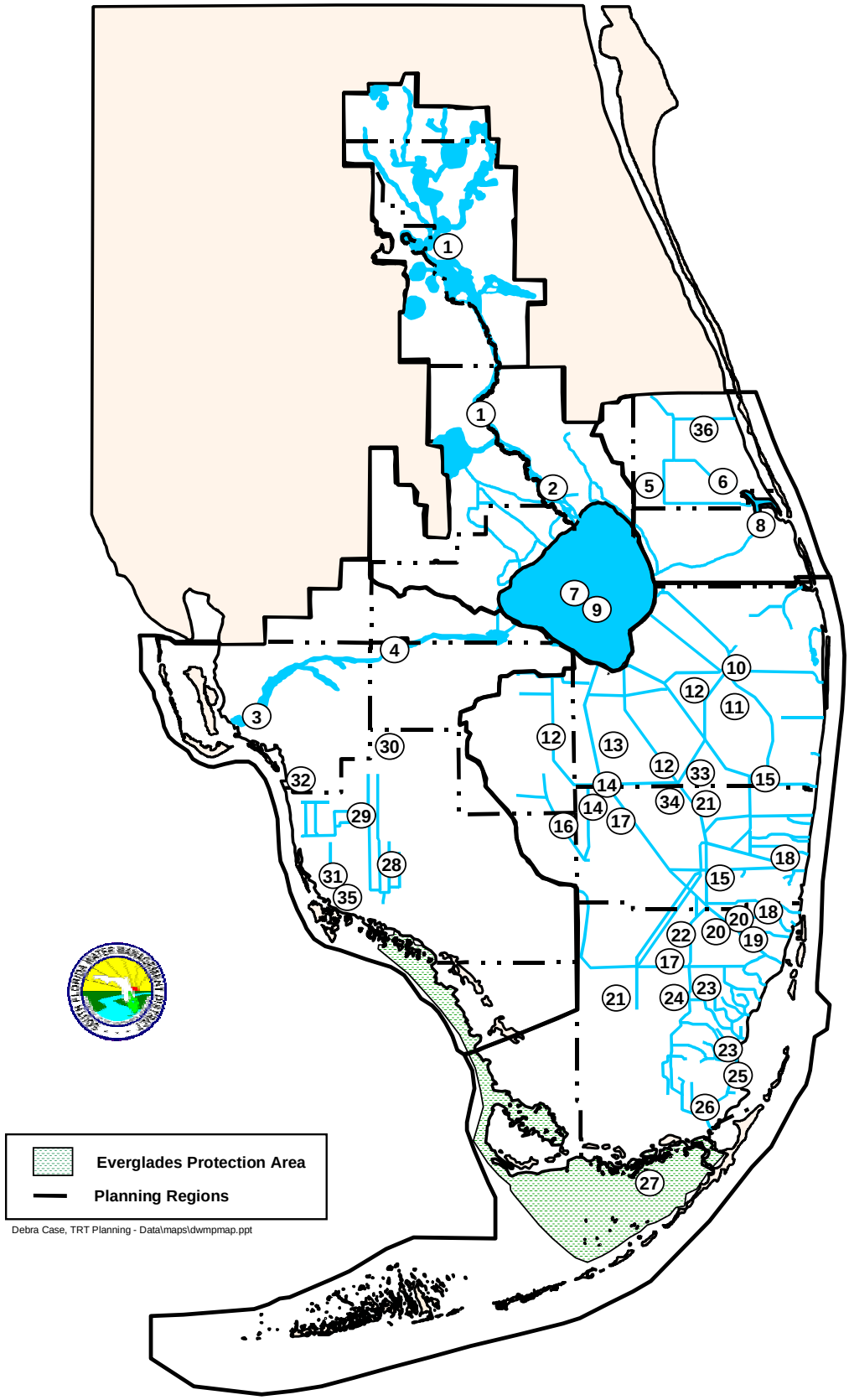


Figure 19. Water Management Infrastructure Needed to Accomplish SFWMD Priorities.

DISTRICT AND OTHER PUBLICLY OWNED LAND

The District is a major landholder in South Florida. It also participates in the protection and preservation of other major public holdings within its boundaries. These public holdings include Everglades National Park, Biscayne Bay National Park, Big Cypress National Preserve, the WCAs, J.W. Corbett Wildlife Management Area (WMA), DuPuis Reserve, Three Lakes WMA, Avon Park Bombing Range, and the Disney Preserve (Walker Ranch).

One of the most important natural resources for the District is the remaining Everglades. This nationally significant resource includes Everglades National Park and the WCAs. The expanse and geographic distribution of these public lands make them key tools for preserving important water resource corridors throughout the District (**Figure 20**). These corridors include major wetland systems and important rivers and sloughs. Many of these wetlands and environmentally sensitive upland areas are associated with rivers or natural flowways such as the Kissimmee and Loxahatchee rivers.

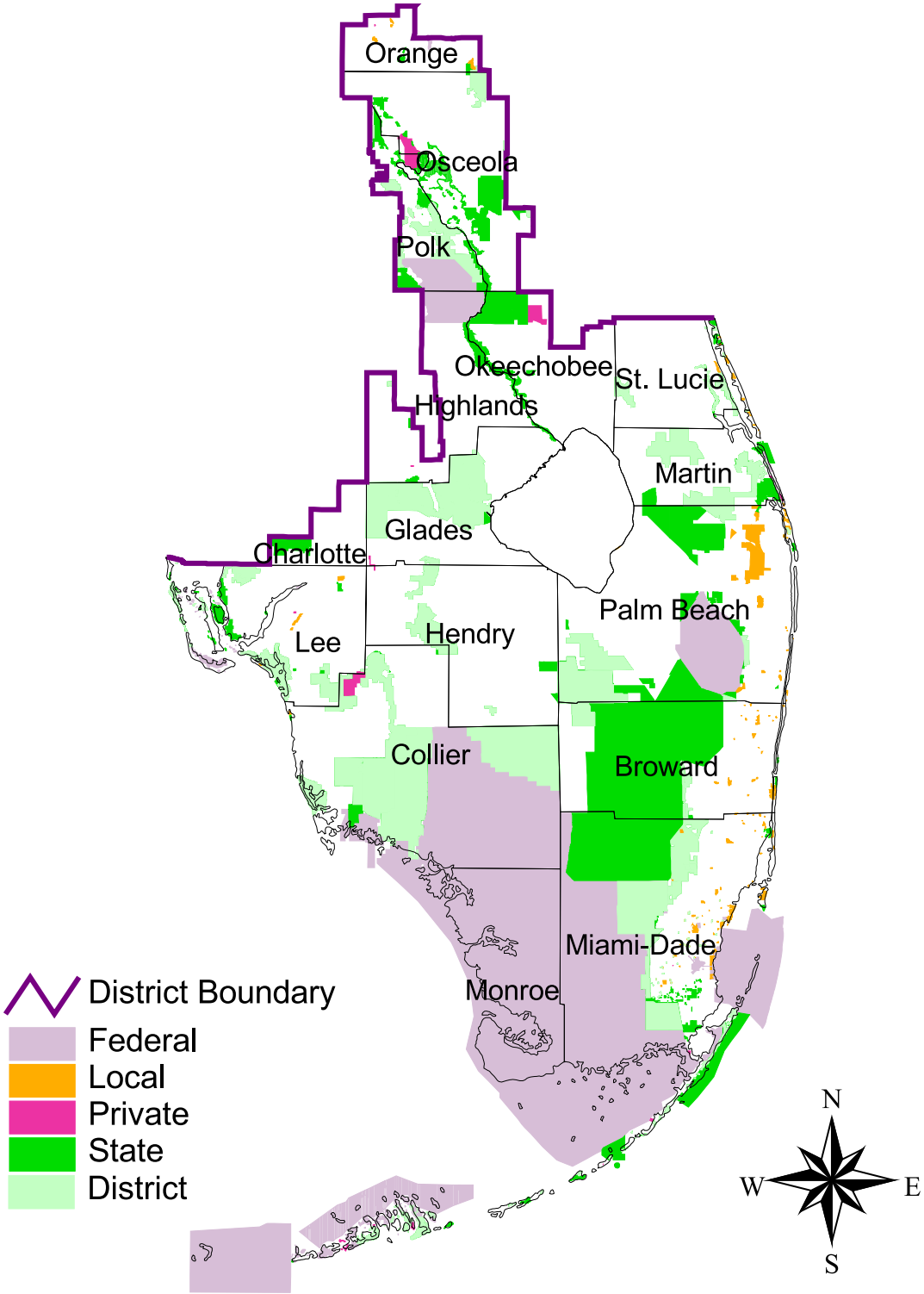


Figure 20. Public Land Ownership within the SFWMD.